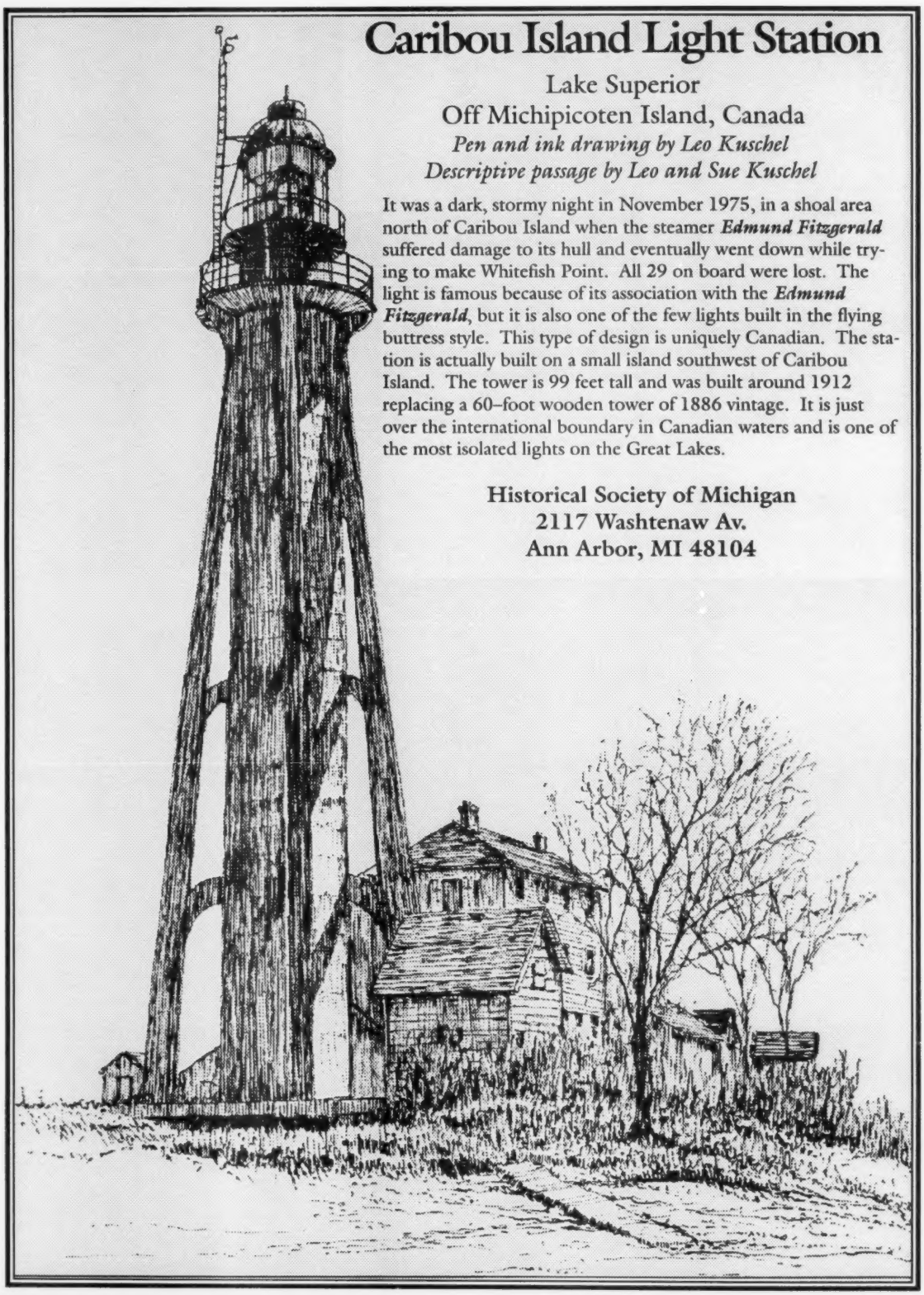
Mariners Weather Log

Fall 1992



Caribou Island Light Station

Lake Superior
Off Michipicoten Island, Canada

Pen and ink drawing by Leo Kuschel
Descriptive passage by Leo and Sue Kuschel

It was a dark, stormy night in November 1975, in a shoal area north of Caribou Island when the steamer ***Edmund Fitzgerald*** suffered damage to its hull and eventually went down while trying to make Whitefish Point. All 29 on board were lost. The light is famous because of its association with the ***Edmund Fitzgerald***, but it is also one of the few lights built in the flying buttress style. This type of design is uniquely Canadian. The station is actually built on a small island southwest of Caribou Island. The tower is 99 feet tall and was built around 1912 replacing a 60–foot wooden tower of 1886 vintage. It is just over the international boundary in Canadian waters and is one of the most isolated lights on the Great Lakes.

Historical Society of Michigan
2117 Washtenaw Av.
Ann Arbor, MI 48104

Mariners Weather Log

Fall 1992

Vol. 36, No. 4

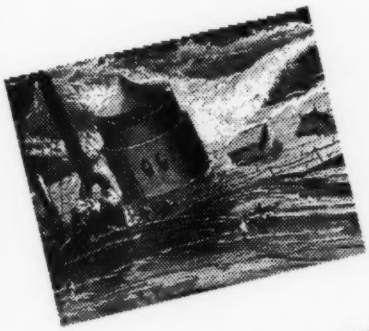
Whale Oil and Wicks and Halloween on page 32.

4
Derelict Ships
Adrienne Mayor
Tales of terrifying wrecks, ghost ships and things that go bump in the night.

11
Overdue
Michael J. Mooney
*For over 60 years, the loss of the **København** has been a mystery of the sea.*

16
Hurricane Andrew—A First Look
Ed Rappaport
A preliminary report on a devastating storm.

1a
Monitor National Marine Sanctuary
Justin Kenney
The Civil War vessel that launched a national sanctuary movement.



The ***Monitor*** remains an important part of our maritime history. Story on page 1a.

Adrienne Mayor brings to life the derelict ships of the past. Story on page 4.

Cover: The unrepentant captain defies God and Nature and condemns his crew to "an eternity of haunting the trade routes" in Howard Pyle's 1900 painting, ***The Flying Dutchman***. The 71 $^{3}/_{8}$" x 47 $^{1}/_{2}$" oil on canvas color painting hangs in Wilmington's **Delaware Art Museum**. Story on page 4.

Back Cover: Fletchers Neck Life–Saving Station is no longer in use, but it is for sale if you have some spare cash. Story on page 40.

Inside Back Cover: Even though the 4th of July was a misty one for the Tall Ship celebration in New York, it didn't dampen the fireworks display. Photograph courtesy of the U. S. Coast Guard and Lt. Tim McGuire, Air Station Brooklyn located at Floyd Bennett Field.

Departments

26 Satellite Snapshots

28 Havens Below

32 Whale Oil and Wicks

36 Sea Photography

40 Lifelines

42 Marine Observation Program

53 Great Lakes Shipwrecks

54 Hurricane Alley

57 PMO Report

63 Ocean Queries

66 Radio Officer Tips

Marine Weather Review

April, May, and June 1992

68 North Atlantic Ocean

71 North Pacific Ocean

74 Pressure and Track Charts

83 Tables

Mariners Weather Log

Editor
Richard M. DeAngelis

Editorial Assistant
Nancy O'Donnell

Columnists
Elinor DeWire
Marty Baron
Michael Halminski
Skip Gillham

Computer Specialist
Gary Keull

Word Processing
Shirley Patterson
Marguerite Little

U.S. Department of Commerce
Barbara Hackman Franklin, Secretary

National Oceanic and Atmospheric Administration
Dr. John A. Knauss, Administrator

National Environmental Satellite, Data, and Information Service
Gregory W. Withee, Acting Assistant Administrator

National Weather Service
Elbert W. Friday Jr., Assistant Administrator

National Oceanographic Data Center
Bruce C. Douglas, Director

The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through July 1, 1993.

The ***Mariners Weather Log*** (ISSN:0025–3367) is published quarterly by the **National Oceanographic Data Center**, National Environmental Satellite, Data, and Information Service, NOAA, Washington DC 20235 (telephone; 202–606–4561). Funding is provided by the National Weather Service, NOAA. Data is provided by the **National Climatic Data Center**, NOAA.

Articles, photographs and letters should be sent to:

Editor, Mariners Weather Log
National Oceanographic Data Center
1825 Conn. Av., NW
Washington DC 20235.

From the Editor

This past summer will be remembered, particularly along the East Coast of the United States, for Hurricane Andrew. The excellent preliminary summary in this issue was prepared at the National Hurricane Center during Andrew's hectic aftermath. It should be mentioned that the National Hurricane Center did a magnificent job under very trying conditions. The most crucial aspect of hurricane forecasting for a populated area is at least 15 to 20 hours advance notice of landfall for an effective evacuation. During Andrew the excellent warnings no doubt saved a large number of lives. In addition, as the impending disaster neared the coast, several of the forecasters were sent to Washington in order to ensure the hurricane warnings continued uninterrupted in case the hurricane center went down. These people had to leave their families to fend for themselves. Also, after the devastation and despite the personal disaster suffered by many of the support staff at the center, they continued to work the long hours necessary to monitor the hurricane and keep the Gulf Coast residents up–to–date on Andrew's progress. The forecasters and all the people who provide the support they need earned praise and gratitude for a job well done at a time when personal considerations weighed heavily on their minds.

The *Fort Lauderdale Sun Sentinel* has published a 96–page full color booklet on Hurricane Andrew with proceeds to go to the Hurricane Relief Fund. The book costs less than $10 and can be ordered by calling 1–800–846–5553 or by writing: Tribune Publishing, Dept. SS, P.O. Box 1100, Orlando, FL 32802

This issue also features some wonderful marine art used to illustrate a well–written story by Adrienne Mayor. The photo on page 4 is a black and white reproduction of Albert Pinkham Ryder's *Flying Dutchman*. From early childhood, the sea played a role in the life of this 19th century Romantic painter. He was born in New Bedford, Massachusetts and many of his ancestors belonged to old Cape Cod families who had followed the sea. His education ended after grammar school, and his training in art didn't begin until he was 24. While other painters traveled to Europe to study the old masters, Ryder went abroad mainly for the sea voyage. Inspired by Wagner's operas, he created the *Flying Dutchman* in the 1880s. He often worked on the same painting for years, applying layer upon layer of glaze and paint. Because he created only 165 paintings, and they became quite valuable in his lifetime, there are many forgeries of his work. The painting featured in the Log is the real thing and hangs in the Museum of American Art in Washington, D.C.

Pyle's *Flying Dutchman* is featured on the cover and is a black and white copy of his original oil color. Howard Pyle, artist, writer, and teacher began his career in Wilmington, Delaware in the late 1880s. His earliest works were illustrations for children's fairy tales and fables published in the magazines of the time. The style used in Pyle's drawings have been described as influenced by a combination of medieval German wood engravings and the work of an English illustrator, Walter Crane. Pyle was fascinated by stories of early colonists, buccaneers, and highwaymen, and by 1887 he began his first pirate story. This theme fills many of his paintings including the one that commands this month's cover. In his *Flying Dutchman*, the evil captain glowers at the waves, unafraid of God or sea, only driven to break the records of fastest speed around Cape Horn.

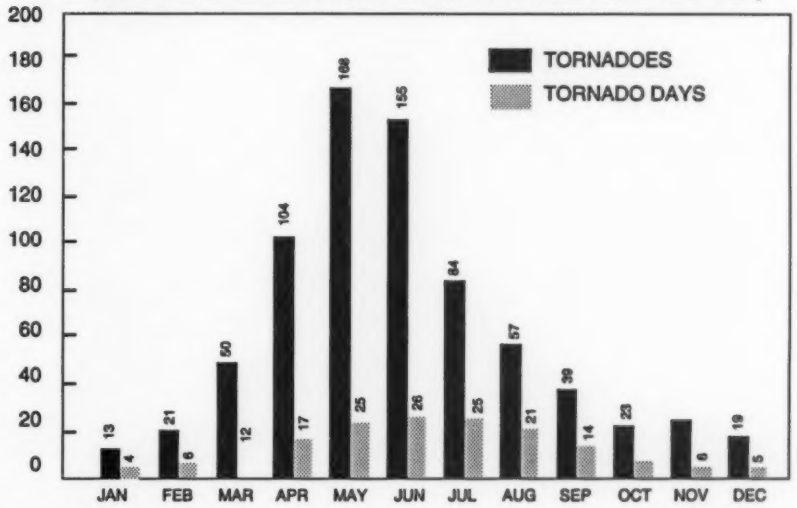
STORM DATA

From NOAA's

National Climatic Data Center

A monthly chronicle of significant and unusual weather events in the United States.

AVERAGE NUMBER OF TORNADOES AND TORNADO DAYS EACH MONTH IN THE UNITED STATES
(BASED ON 28,820 TORNADOES THAT OCCURRED FROM 1953–1990)



- ❍ Great photographs
- ❍ State by State Coverage
- ❍ Thunderstorm and Lightning Statistics
- ❍ Property and Crop Damage Estimates
- ❍ Storm–related Deaths and Injuries
- ❍ Tornado and Hurricane Summaries
- ❍ U.S. Storm Track Charts
- ❍ Annual and Monthly Summaries

Individual months are available for $4 each and a 1 year subscription is $44 (add $5 handling charge to both). Back issues are available from 1959. For more information write:

STORM DATA
National Climatic Data Center, NOAA
Federal Building
Asheville, NC 28801–2733
or call (704) 259–0682

"The Demon Frigate braves the gale / And well the doomed spectators know / The harbinger of wreck and woe."

–Sir Walter Scott

Derelict Ships

Adrienne Mayer

During a mast-snapping hurricane in 1944, the freighter ***Rubicon*** broke her moorings in Havana's harbor. With only a dog on board, she drifted off into the Gulf Stream. The U.S. Coast Guard retrieved her some months later near the Florida coast.

In 1932 the engine of the schooner ***John and Mary*** exploded off New Jersey and her crew fled. The empty schooner stayed afloat, however, and sailed upon the seas with sail still furled and a freshly painted hull. She eventually was found 50 miles south of Bermuda.

The ***Fannie E Wolston,*** during her unguided early 1890s voyage, covered 8,965 miles in 3 years; she was sighted 46 times.

The circumstances of the derelict brig that sailed ashore on Easton's Beach near Newport, Rhode Island in 1750 were even more mysterious. Fishermen who boarded her found only a dog and a cat. The table was laid, a kettle and pots of food were on the stove, but no trace of the crew. The ship had set sail from Newport months earlier and had docked in Honduras, but then what? There was no way of knowing when or why the crew vanished or what propelled the coincidental homecoming.

A floating vessel that has been deserted by her crew is called a derelict under maritime law. Seaworthy derelicts, especially those with buoyant cargo such as timber, can float for years carried by prevailing winds and currents for thousands of miles until they run aground or rot away. During the glory days of sailing, thousands of abandoned and disintegrating wooden ships of all descriptions drifted at sea, disabled by storms, fires, leaks, explosions, mutiny, or disease on board. Sailors sometimes saw the same decaying hulk twice--months apart and in different latitudes. A floating or half-submerged wreck could loom up unexpectedly in fog or at night. The terrifying sight and true danger inspired a mythology of malevolent ghost ships.

A floating or half submerged wreck could loom up unexpectedly in fog or at night. The terrifying sight and true danger inspired a mythology of malevolent "ghost ships."

According to sailing lore, a vessel involved in disaster can become a ghost, ceaselessly wandering and foretelling evil for all who encounter her. Such a tale is the Flying Dutchman, which comes in many versions. Each rendition has some features in common: an arrogant captain defies Nature or God, sometimes by making a pact with the Devil, and causes misery and death for his crew. Usually the mad captain drives his ship

*To write **The Rime of the Ancient Mariner** (1798), Samuel Coleridge drew on experiences of ships becalmed in the horse latitudes, actual sightings of ships with frozen corpses on deck, and the true story of a privateer who, while rounding Cape Horn in 1720, was dogged by bad fortune after he shot an albatross. The bird, a sign of purity, freedom, and the safety of land, then became a symbol of the mariner's guilt and Nature's reproach. The painting (left) is the **Flying Dutchman** by Albert Pinkham Ryder. It was done in 1887 and is an oil on canvas mounted on fiberboard. Permission to reproduce the black and white print of this color painting was kindly given to us by the **National Museum of American Art, Smithsonian Institution.** The painting was a gift of John Gellatly.*

*The number of drifting derelicts began to decrease toward the end of the 19th century along with the decline of sailing ships and the rise of steam power and metal hulls. Another factor in their decline was the search and destroy missions of the U.S. Navy and U. S. Revenue Cutter Service. The Revenue Cutter Service was a forerunner of the U.S. Coast Guard. At right, the derelict schooner **Josephine** was being towed by Coast Guard cutters on May 10, 1922.*

and men to inhuman limits to break speed records rounding either Cape Horn or the Cape of Good Hope. Other versions tell of murder, mutiny, or dark deeds that doomed the cursed ship to an eternity of haunting the trade routes. These grim ships loomed up suddenly alongside ordinary vessels, and the frightened crews often imagined that they saw ghosts or demons hauling on the ropes and at the wheel.

The idea that something associated with violent death can become a ghostly harbinger of future tragedy seems almost universal.

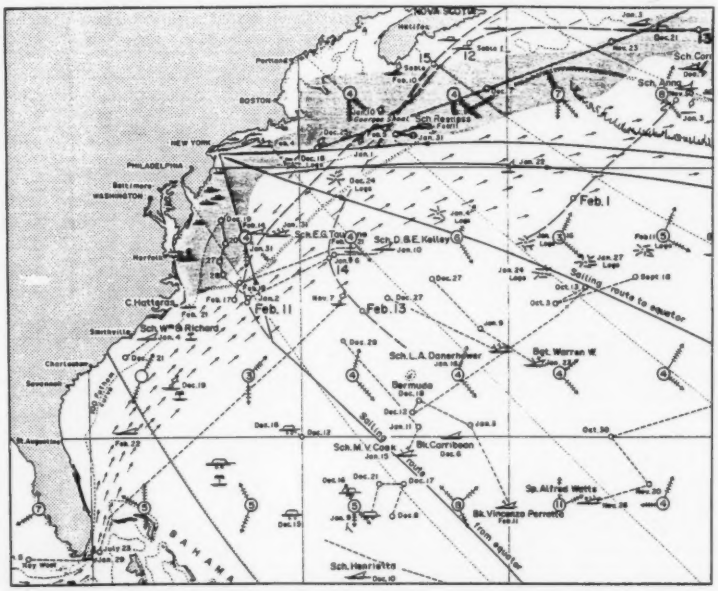
Homer's *Odyssey* first described a phantom ship and set the mystical tone for the myths that followed. The homesick sailor Odysseus was given a lift by a crew of ghostly seamen who were said to patrol the seas in specter barks with no rudders or helmsman, reading men's thoughts, and ferrying the blameless to their rewards. But the phantom ship legend is not solely a Western tradition. An Arabian version details the curse cast on the bloodthirsty pirate Dahoul: "You shall wander on every sea until the end of time, at the will of the winds and the mercy of the waves. Your crew will exhaust itself in endless toil. Your passengers will be the drowned of the world; you shall never die nor will you ever reach shore."

Many other cultures have associated supernatural ships with guilt or death. Old English, German, Scandinavian, and Asian myths described magical ships that transported the souls of the dead. Medieval French and Italian histories tell of phantom boats seen on anniversaries of shipwrecks. The idea that something associated with violent death can become a ghostly harbinger of future tragedy seems almost universal. Such beliefs have also inspired art and literature. Richard Wagner based a famous opera (1843) on Flying Dutchman tales; Washington Irving and Edgar Allen Poe both wrote stories about spectral ships with demon crews. The Flying Dutchman legend probably arose from a mixture of superstitions about such ghosts and from sailors' early contact with other seafaring peoples who sent their dead out to sea in boats. Not surprisingly, wrecked, sunken, or deserted ships were the most common candidates for ghosthood.

The famous derelict brigantine ***Mary Celeste*** generated speculation of mutiny and foul play. The ***Mary Celeste*** sailed from New York for Genoa in 1872, and her log reported a position 100 mile west of the Azores on 24 November. The ***Dei Gratia*** found her about 2 weeks later, completely deserted with the crews' clothes hung out to dry, drifting about 500 miles from the last reported position. The ship's papers, except for the logbook, were gone. No survivors were found. The captain to the ***Dei Gratia*** was an acquaintance of the ***Mary Celeste***'s skipper; he hauled the derelict to Gibraltar and claimed a huge ransom in salvage. Suspicions about his profitable discovery lingered for decades, and the ***Mary Celeste*** was plagued by bad luck until her final wreck in 1885.

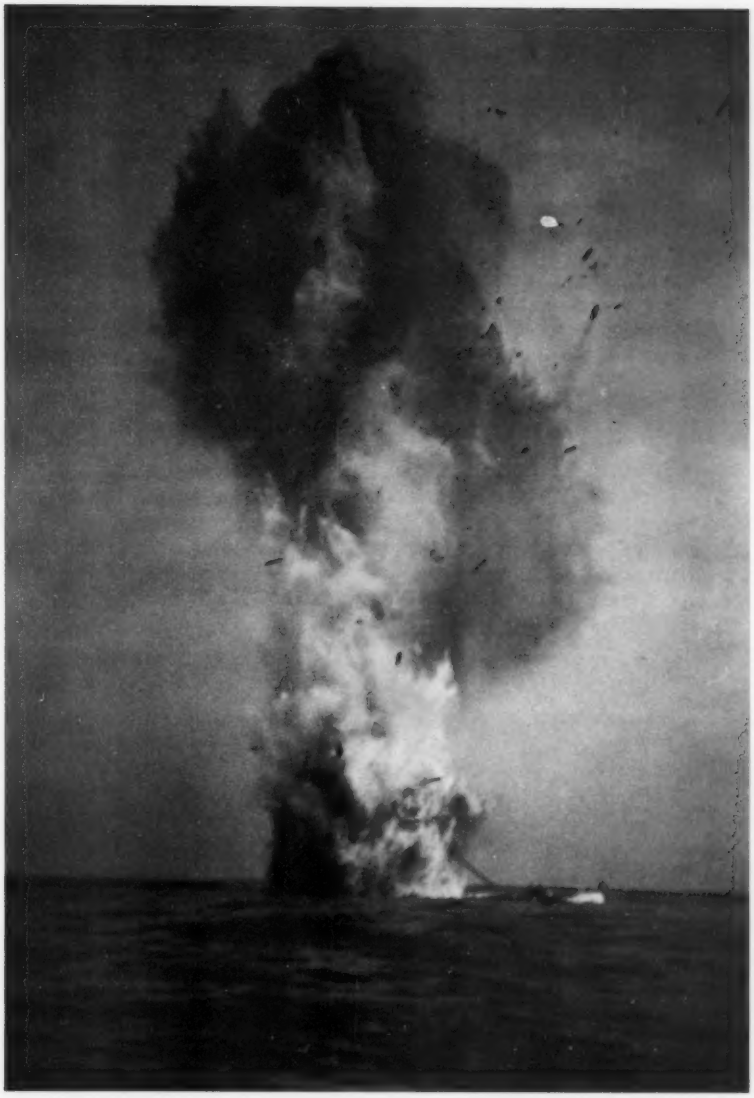
Philip Richardson of Woods Hole Oceanographic Institution says that "the Atlantic was literally strewn with ***Mary Celestes*** in various stages of disintegration" in the late 1880s.

Sea-lore writer Peter Freuchen says that derelict vessels loom large in sailor's stories simply because "there is no more terrifying peril to meet on



A portion of the March 1888 Pilot Chart shows the trajectories of ten derelicts and three buoys. Symbols schematically represent the condition of each derelict– stern down, bottom up, masts standing, etc. In addition to these are steamship routes, current vectors, fog belts, limits of ice, wrecks, waterspouts, whales, storm tracks, prevailing winds, etc. This chart appeared in Philip Richardson's ***Drifting Derelicts in the North Atlantic Ocean 1883–1902.***

The U.S. Navy and U.S. Revenue Service (forerunner to the Coast Guard) began to remove the derelicts either by towing or by sinking. The Coast Guard (left) broke up a derelict barge by setting TNT mines.



U. S. Coast Guard

the Seven Seas than the almost invisible hull of a dead ship which can itself kill the living." The grave navigational hazards posed by derelicts were a constant problem in the 19th and early 20th centuries.

... —Phonecian galleys, Roman triremes, Spanish treasure galleons, pirate vessels, frigates, clippers, steamers, packets, and yachts—haunted the Gulf Stream.

The rescuers of the crew of the British coalship ***Rumney*** had a hair-raising experience with a derelict in a dense Atlantic fog in 1884. The ***Rumney*** rescued the crew of the sinking French steamer ***Frigorifique,*** which was listing steeply, the engine room flooding with water surging in through a huge hole amidships. As the ***Rumney*** was groping in the fog at 2 knots, a ship loomed suddenly dead ahead. The ***Rumney*** barely managed to dodge the phantom and continued on course. Again the same great ship bore down on the sailors from the gloom, and this time everyone could see that the phantom was the ***Frigorifique,*** apparently risen from the deep. The ***Rumney*** was rammed and sank immediately. Fortunately, all hands escaped in lifeboats. The dangerous derelict was discovered later, still listing badly but with one propeller turning and smoke rising from one funnel. The wheel had been lashed, which kept her turning a wide circle—that was how she had twice crossed the British ship's course.

By 1883, mariners who encountered derelicts in the Atlantic began reporting the positions to the U.S. Navy Hydrographic Office in Washington, D.C. The derelicts' positions were plotted on a huge blackboard and updated in monthly Pilot Charts, issued free to navigators. Between 1887 and 1893, the office received 1,628 sightings of abandoned ships. More than 400 derelict wooden sailing vessels were spotted after the fierce hurricanes of 1883 alone.

Such ghost ships, some floating upright, dismasted, overturned, or flooded to the gunwales, meandered for thousands of miles. Despite the attempts to record their positions, these treacherous ships were difficult to track down.

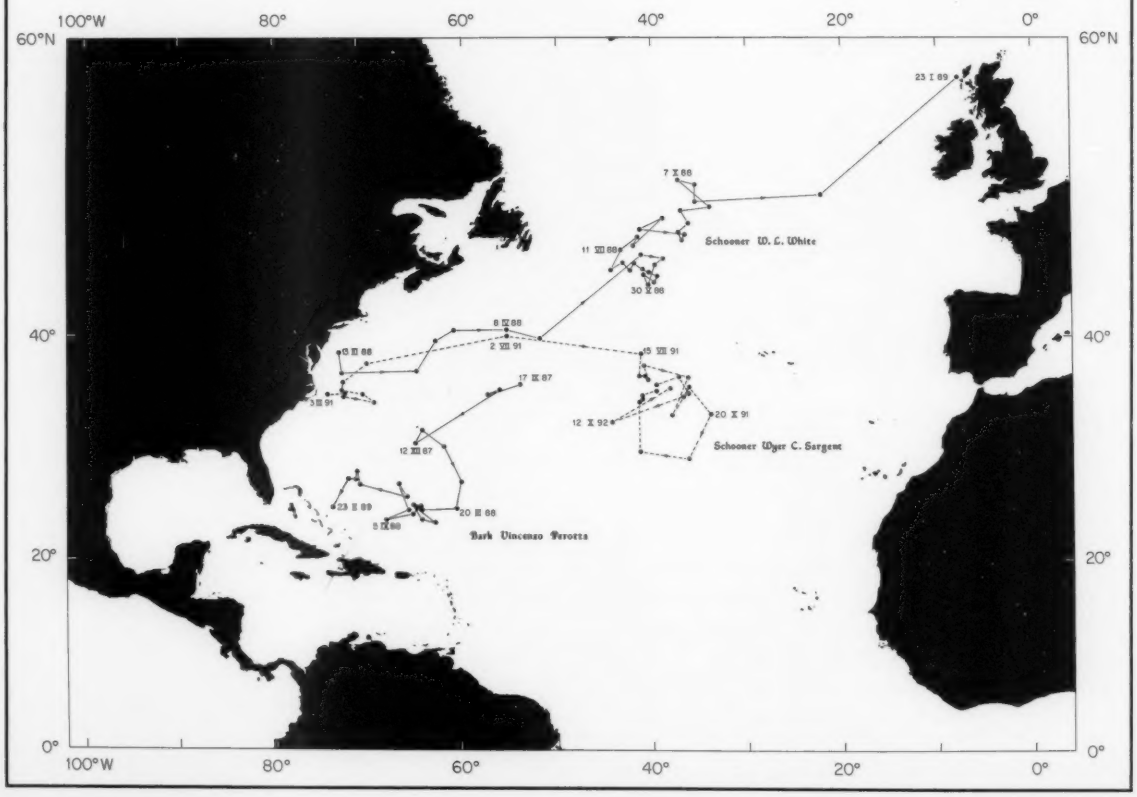
Between 1887 and 1893, six ships were lost and fifteen were severely damaged in collisions with derelicts. Of the 1,628 derelicts drifting during those years, only 41 were towed in, and 72 were destroyed by setting them afire. One, the waterlogged three-masted schooner ***Drisko,*** loaded with lumber, was sunk with great difficulty by the ***USS San Francisco*** near Key West, Florida. The ***San Francisco*** ended up

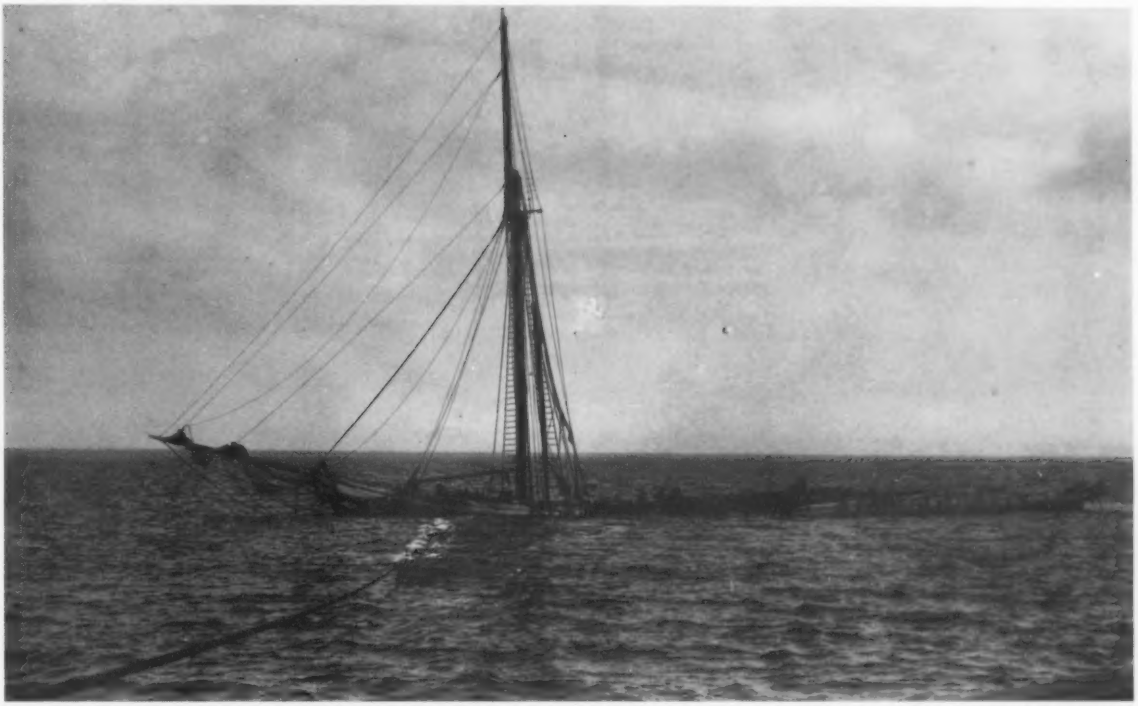
Pilot Charts and Derelicts

In December 1883 the U.S. Navy Hydrographic Office began to publish monthly Pilot Charts for the North Atlantic. These were preceded by Maury's survey charts, which showed ocean currents, winds, sailing routes, and the location of whales. The new charts showed updated positions of derelicts and other drifting debris. The success of the Pilot Charts were due to the large number of observers who contributed weather and other information for each month's charts. From these charts Philip Richardson was able to compile trajectory charts of derelicts between 1883 and 1902, which showed the features of the general ocean circulation and early evidence of the variability of ocean currents. The results of this study were presented in a paper entitled *Drifting Derelicts in the North Atlantic 1883–1902*. It appeared in **Progress in Oceanography**, (1985) Vol. 14, pp. 463–483.

From **Pilot Chart**, July 1889– "Of the many wrecks afloat this month in the North Atlantic Ocean, none has as interesting a history as the Italian Bark *Vincenzo Perrotta*. Abandoned September 18, 1887, this vessel has been represented graphically on every edition of the **Pilot Chart** published since that time. Her wonderful drift began in about latitude 36°N, longitude 54°W; and on April 4, 1889, when last reported, she was about 60 miles north of Watling's Island, in the Bahamas. She thus made a good distance of about 1,400 miles in a general southwest by west direction, in 1 year, 6 months, and 16 days. She has been reported 27 times in all, and when last seen had mizzenmast and about 10 feet of mainmast standing, foremast gone, end of jibboom broken off and port anchor on bow."

From **Pilot Chart**, February 1889– "The schooner *W. L. White*, lumber-laden, was abandoned, water-logged, about 80 miles east southeast from Absecon Light. All masts standing, two reefs in mainsail, American flag (union down) in mizzen cross-trees, burgee about halfway up mizzen rigging. Wind west northwest, very heavy for 24 hours before abandoning the vessel."– Mr. George Phillips, Second Officer, schooner *W. L. White*.





U. S. Coast Guard

*The derelict schooner **Adelaide Day** was spotted some 240 miles east of Cape Hatteras, North Carolina. It was picked up by the U. S. Coast Guard Cutter **Manning** and towed to Hampton, Virginia in November of 1927. The U. S. Revenue Service even had a manual called **Methods of Searching for Derelicts at Sea**, which was published in 1913.*

ramming the schooner and broke her in two; then, as it was getting dark, a few more shells were fired into her stern for good measure. The ***Drisko***'s bad luck had begun when she encountered a younger derelict in the Gulf of Mexico in 1891; she was abandoned after a collision and drifted for 2 years, an elusive omen of the dangers of life at sea. The Navy Hydrographic Office reports that in 1893 the ***San Francisco*** fired eight torpedoes at the ragged schooner, which remained afloat.

Benjamin Franklin was probably the first writer to take a scientific interest in the position of crewless ships in the Atlantic shipping lanes.

Some sea tales claim that sunken ships can rise from the ocean floor. Freuchen recalls a schooner that was seen to sink out of sight by her own crew off the coast of Portugal, but days later they saw their ship, resurrected, floating on her side. And off the Carolina coast, a series of photographs show the schooner ***A. Ernest Mills*** as she rose to the surface days after she had gone down in a storm. Experts suggest that these two ghost ships might have been carrying cargoes of salt. Warren Wren, ranger at Cape Hatteras, North Carolina says: "Ships carrying commodities such as salt, sulfur or phosphorus could have gone down in storms only to rise again after the cargo dissolved." Wren says that ships that were "only swamped and then suspended just below the surface, or ships that sank but were never snagged on the bottom," might float up for a number of reasons: shifting shoals or strong currents, ship/cargo buoyancy, erosion or buildup of shorelines, and violent storms. "Even if it happened only every few decades, the mysterious sight would have made quite an impression," he says, especially along the perilous sea lanes off the Outer Banks, known as the *Graveyard of the Atlantic.* Sailors claimed that vessels from every era of seafaring—Phoenician galleys, Roman triremes, Spanish treasure galleons, pirate vessels, frigates, clippers, steamers, packets, and yachts—haunted the Gulf Stream.

Benjamin Franklin probably was the first writer to take a scientific interest in the position of crewless ships in the Atlantic shipping lanes. After talking with experienced sailors, Franklin speculated about a continuous great current that could help or hinder a

"The Derelict"
H. M. Tomlinson
(excerpt)

Something strange was to be seen upon the waters. It looked like a big log out there ahead, over the starboard bow. It was not easy to make out. The light was failing. We overhauled it rapidly, and it began to shape as a ship's boat. "Oh it's gone," exclaimed someone then. But the forlorn object lifted high again, and sank once more. Whenever it was glimpsed, it was set in a patch of foam.

That floatsam, whatever it was, was of man. As we watched it intently, and before it was quite plain, we knew intuitively that hope was not there, that we were watching something past its doom. It drew abeam, and we saw what it was, a derelict sailing ship, mastless and awash. The alien wilderness was around us now, and we saw a sky that was overcast and driven, and seas that were uplifted, which had grown incredibly huge, swift, and perilous, and they had colder and more somber hues.

The derelict was a schooner, a lifeless and soddened hulk, so heavy and uncontesting that its foundering seemed at hand. The waters poured back and forth at her waist, as though holding her body captive for the assaults of the active seas which came over her broken bulwarks and plunged ruthlessly about. There was something ironic in the indifference of her defenseless body to these unending attacks. It mocked this white and raging postmortem brutality and gave her a dignity that was cold and superior to all the eternal powers could do now. She pitched helplessly headfirst into a hollow, and a door flew open under the break of her poop; it surprised and shocked us, for the dead might have signed to us then. She went astern of us fast, and a great comber ran at her, as if it had just spied her and thought she was escaping. There was a high white flash, and a concussion we heard. She had gone. But she appeared again far away, on a summit in desolation, black against the sunset. The stump of her bowsprit, the accusatory finger of the dead, pointed at the sky ...

This passage was found in a wonderful publication entitled the **Ocean Almanac** by Robert Hendrickson.

ship's progress. Today oceanographers study past sightings of ghost ships reported at the turn of the century to clarify the dimensions, direction, and velocity of the surface of the Gulf Stream.

At Woods Hole, Richardson analyzed the trajectories of 200 derelict ships reported by name in the monthly Pilot Charts from 1883 to 1902. He superimposed maps of their routes in the Gulf Stream and discovered interesting patterns. When the lumber schooner **W.L. White** was abandoned in a blizzard in Delaware Bay in March 1888, she drifted south with all three masts and portions of sails still standing. Then she was taken up by the Gulf Stream and turned east-northeast. That summer and fall, "she looped and zigzagged east of Newfoundland directly within a major shipping lane," says Richardson. Nearly a year and 6,000 miles later, the ***W.L. White*** ran aground in the Hebrides Islands, Scotland. During her journey, 36 other vessels passed her. The captains' reports trace her degeneration into a blackened hulk left with only parts of two masts, bowsprit and deck rotted away, hull covered with grass and barnacles.

According to Richardson's data, it typically took about 10 months for a derelict to drift clockwise from Cape Hatteras to Europe, and "a complete circuit of the gyre" averaged three years. Many of the derelicts made tight turns or traced large loops; their criss-crossing, convoluted trajectories indicate a branching of the Gulf Stream near Newfoundland and suggest the presence of strong counter-eddies within the current.

Richardson points out that the number of derelicts declined after 1900, partly because of "the rise of iron, steel, and steam." Steamships were "abandoned less often and those that were...tended to sink, no remain afloat as derelicts," he says. Efforts by naval vessels and the Revenue Cutter Service (forerunner of the U.S. Coast Guard) to pinpoint derelicts and destroy them also contributed to the decline.

As steam eclipsed sails and the numbers of derelicts waned, so too did the legends attached to drifting hulks.

Horace Beck, collector of folklore about the sea, says that the ***Andrea Doria***, the ***Lusitania***, the ***Morro Castle***, and the ***Normandie***, all victims of great sea disasters, inspired no tales of ghost ships. When he asks Caribbean sailors about the dearth of haunted ships these days, they point out that ghosts and spirits prefer sails—they avoid engine fumes.

Adrienne Mayor is a free-lance writer and editor who lives part time in Bozeman, Montana and part time in Princeton, New Jersey. She has written for ***Sea Frontiers*** *and* ***Popular Science Annual*** *among others. Her ocean-oriented work includes dolphin folklore, inexplicable phenomena observed at sea, ancient Greek and Roman shipwrecks, mermaids, sea monsters and Mediterranean wind lore.*

Derelict Ships originally appeared in the August 1992 issue of ***Sea Frontiers****, a publication of The International Oceanographic Foundation/Nature America located at 4600 Rickenbacker Causeway, Miami, FL 33149.*

Overdue

Michael J. Mooney

"The Derelict"
H. M. Tomlinson
(excerpt)

Something strange was to be seen upon the waters. It looked like a big log out there ahead, over the starboard bow. It was not easy to make out. The light was failing. We overhauled it rapidly, and it began to shape as a ship's boat. "Oh it's gone," exclaimed someone then. But the forlorn object lifted high again, and sank once more. Whenever it was glimpsed, it was set in a patch of foam.

That floatsam, whatever it was, was of man. As we watched it intently, and before it was quite plain, we knew intuitively that hope was not there, that we were watching something past its doom. It drew abeam, and we saw what it was, a derelict sailing ship, mastless and awash. The alien wilderness was around us now, and we saw a sky that was overcast and driven, and seas that were uplifted, which had grown incredibly huge, swift, and perilous, and they had colder and more somber hues.

The derelict was a schooner, a lifeless and soddened hulk, so heavy and uncontesting that its foundering seemed at hand. The waters poured back and forth at her waist, as though holding her body captive for the assaults of the active seas which came over her broken bulwarks and plunged ruthlessly about. There was something ironic in the indifference of her defenseless body to these unending attacks. It mocked this white and raging postmortem brutality and gave her a dignity that was cold and superior to all the eternal powers could do now. She pitched helplessly headfirst into a hollow, and a door flew open under the break of her poop; it surprised and shocked us, for the dead might have signed to us then. She went astern of us fast, and a great comber ran at her, as if it had just spied her and thought she was escaping. There was a high white flash, and a concussion we heard. She had gone. But she appeared again far away, on a summit in desolation, black against the sunset. The stump of her bowsprit, the accusatory finger of the dead, pointed at the sky ...

This passage was found in a wonderful publication entitled the **Ocean Almanac** by Robert Hendrickson.

ship's progress. Today oceanographers study past sightings of ghost ships reported at the turn of the century to clarify the dimensions, direction, and velocity of the surface of the Gulf Stream.

At Woods Hole, Richardson analyzed the trajectories of 200 derelict ships reported by name in the monthly Pilot Charts from 1883 to 1902. He superimposed maps of their routes in the Gulf Stream and discovered interesting patterns. When the lumber schooner **W.L. White** was abandoned in a blizzard in Delaware Bay in March 1888, she drifted south with all three masts and portions of sails still standing. Then she was taken up by the Gulf Stream and turned east-northeast. That summer and fall, "she looped and zigzagged east of Newfoundland directly within a major shipping lane," says Richardson. Nearly a year and 6,000 miles later, the ***W.L. White*** ran aground in the Hebrides Islands, Scotland. During her journey, 36 other vessels passed her. The captains' reports trace her degeneration into a blackened hulk left with only parts of two masts, bowsprit and deck rotted away, hull covered with grass and barnacles.

According to Richardson's data, it typically took about 10 months for a derelict to drift clockwise from Cape Hatteras to Europe, and "a complete circuit of the gyre" averaged three years. Many of the derelicts made tight turns or traced large loops; their criss-crossing, convoluted trajectories indicate a branching of the Gulf Stream near Newfoundland and suggest the presence of strong counter-eddies within the current.

Richardson points out that the number of derelicts declined after 1900, partly because of "the rise of iron, steel, and steam." Steamships were "abandoned less often and those that were...tended to sink, no remain afloat as derelicts," he says. Efforts by naval vessels and the Revenue Cutter Service (forerunner of the U.S. Coast Guard) to pinpoint derelicts and destroy them also contributed to the decline.

As steam eclipsed sails and the numbers of derelicts waned, so too did the legends attached to drifting hulks.

Horace Beck, collector of folklore about the sea, says that the ***Andrea Doria***, the ***Lusitania***, the ***Morro Castle***, and the ***Normandie***, all victims of great sea disasters, inspired no tales of ghost ships. When he asks Caribbean sailors about the dearth of haunted ships these days, they point out that ghosts and spirits prefer sails--they avoid engine fumes.

Adrienne Mayor is a free-lance writer and editor who lives part time in Bozeman, Montana and part time in Princeton, New Jersey. She has written for ***Sea Frontiers*** *and* ***Popular Science Annual*** *among others. Her ocean-oriented work includes dolphin folklore, inexplicable phenomena observed at sea, ancient Greek and Roman shipwrecks, mermaids, sea monsters and Mediterranean wind lore.*

Derelict Ships originally appeared in the August 1992 issue of ***Sea Frontiers****, a publication of The International Oceanographic Foundation/Nature America located at 4600 Rickenbacker Causeway, Miami, FL 33149.*

Overdue

Michael J. Mooney

In 1925 a writer in *The Nautical Magazine* provides an unwitting premonition of the fate of the ***København***, one of the last of the great five-masted sailing ships. Such ships, he writes, "have not enjoyed long careers...disaster appears to follow in their wake." And of the ***København***, he writes, "But for this British-built Great Dane, with her stalwart figurehead, we shall wish for better fortune." Would that it had been so.

For over 60 years, the ***København***'s unaccountable loss has been a premier mystery of the sea comparable to the disappearance of the ***Mary Çeleste***. There are many theories, but most believe that the ***København***'s end was probably without warning because although she had been carrying wireless with a 400 mile range, no distress signal was ever received. The sea had, quite simply, swallowed her whole.

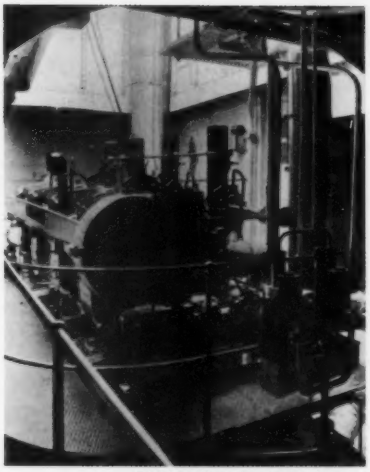
The loss becomes more tragic when the particulars of the sinking are known. The ***København*** was a school-ship teaching deep water seamanship to cadets, and of her complement of 60 hands, 45 were 14 to 20-year-olds. This fact prompted the longest, most exhaustive, and desperate search ever mounted for a missing ship under any flag.

Photographs of the ship show a genuine heartbreaker– a full-rigged beauty with perfect, graceful lines and classic, sweeping proportions that belied its impressive dimensions. When fully loaded and viewed from abeam, the ***København*** was slim-waisted with distinctive white sash-like bands. Acres of billowing sails above completed the picture.

It was first launched in 1914 from the yards of Ramage and Ferguson at Leith, Scotland, but World War I intervened and construction was halted. After the war, the ***København*** was begun anew and finally wet her keel March 24, 1921.

On September 30, 1921, it departed Leith for Copenhagen to prepare for an auspicious world

København on the high seas is an artist's conception of this beautiful vessel whose name evokes among saltwater sailors the kind of memories associated with another great sailing mystery the Mary Celeste. However, the fact that so many young cadets were involved makes this a particularly heartrending loss. The photograph was furnished by Det Ostasiatske Kompagni, Copenhagen.



B&W Engineering, Copenhagen

Like most twentieth century full-rigged ships, the Københavnn carried auxiliary power; her Burmeister and Wain 650 hp marine diesel., when needed, could drive her at 6 knots.

circumnavigation. Aboard were the captain and officers, boatswains, sailmakers, carpenter, 26 able-bodied and ordinary seamen, and the cadets.

During the 1920s the ship's log of successful voyages increased to nine as it visited virtually every continent and traversed all the major oceans and seas. Word of its arrival heightened expectations of seeing one of the last true glories of the sea.

Its tenth and final passage began at Copenhagen on September 14, 1928. With full holds it reached down both Atlantics to arrive at Buenos Aires on November 17th.

For almost a month the ***Københavnn*** waited in vain for a suitable cargo. Finally, Captain Hans Andersen decided to sail her in ballast to Australia where a shipment of wheat was waiting. On Friday, December 14, the ship, with provisions for 6 months at sea, stood out from the River Plate. A normal run would have taken it about 45 days.

The ***Københavnn*** was last heard on the evening of Saturday, December 22, 1928, when the captain spoke to the Norwegian steamer ***William Blumer*** and the ***City of Auckland***. Pleasantries were exchanged, and the ship reported that her cadets were preparing to celebrate Christmas when they reached the Cape of Good Hope. No further word was ever received though the ***William Blumer*** tried to reach her again that very night.

The weeks passed and the ***Københavnn***'s estimated arrival date in Australia came and went without a word. At first this was not considered unusual; the ship had been silent before and for longer periods. What's more, it was known that Captain Andersen used the wireless only when absolutely necessary.

As the austral summer waned, newspapers began to mention the ***Københavnn*** more frequently, noting how it was becoming more overdue with each passing day. The papers emphasized that it was carrying the young cadets, considered the cream of Denmark's future maritime leadership, many from the nation's most prominent families.

By mid-February, the East Asiatic Company inquired at Lloyd's of London for any information concerning the missing ship. Nothing.

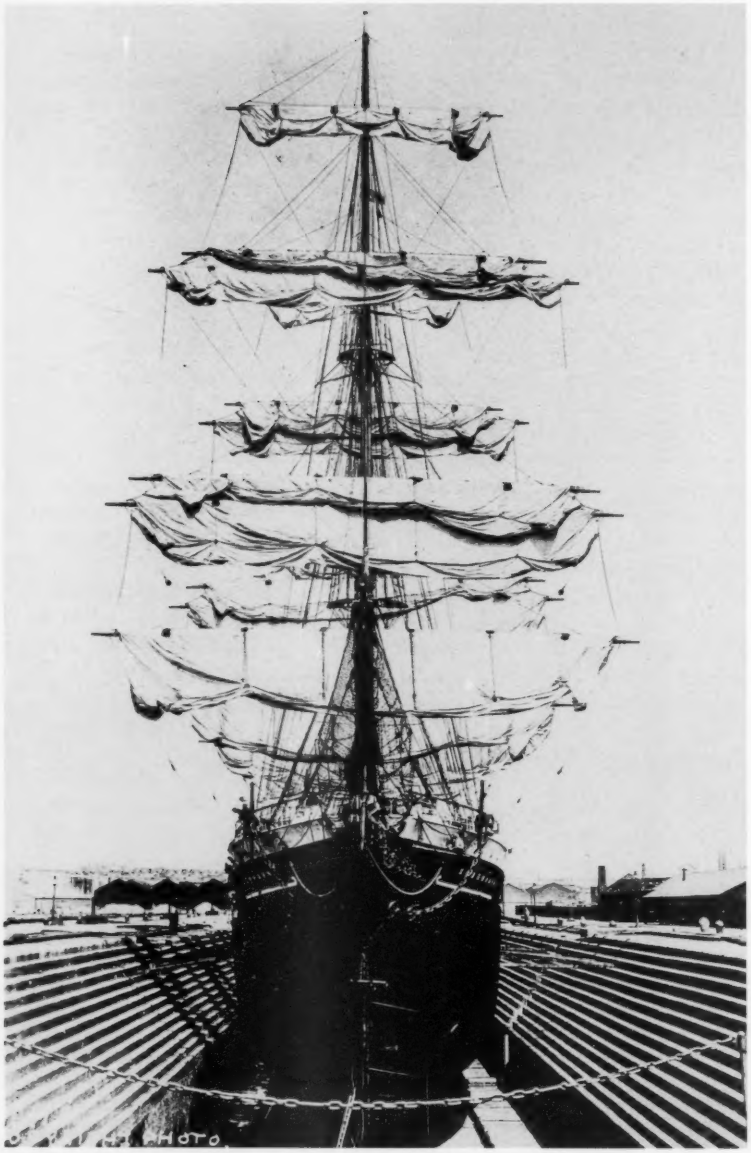
By April 11, East Asiatic asked British maritime interests to have their ships search the South Atlantic and South Indian Oceans, and the widely scattered islands in the event that the ship had been dismasted or driven ashore. By this time, the ships' reinsurance rate at Lloyd's had also soared to an alarming 90%—usually the sign

Captain R. Peter Emdall

*Group photograph of **Københavnn** crew, cadets, and shore officials was taken in Honolulu, Hawaii during a 1923 visit. Able Seaman Emdall stands in second row from bottom, fourth in from left.*

*Michael Mooney works as a free-lance writer/photographer based in New York, and we have been priviledged to publish several of his excellent articles in the past. Mooney specializes in the environment, particularly oceanography, meteorology, and other natural phenomena. His work has appeared in **Oceans, Popular Mechanics, Ocean Navigator, Science Digest, The Compass** and a host of other magazines.*

Several of his articles have been selected and reprinted by the Reader's Digest Association, Oxford Press, Doubleday & Company, and Danmarks Skibsfart in Copenhagen.



The Københavnin drydock during the 1920s. The "Big Dane," with masts towering as high as a 20-story building, measured 430 feet overall and grossed 3965 tons. Built to Lloyd's of London survey for 100A1 Class vessels, it satisfied both British Board of Trade and Danish maritime requirements. Photograph courtesy of Edwardes Collection of the State Library of South Australia.

of a loss at sea.

Thus began an exhaustive 5-month sea search, the longest, farthest reaching, and most costly in the history of maritime service. Vast reaches of ocean were methodically quartered and searched—and searched again. Every island and continental coastline remotely within the range of the ***København*** was investigated by different search vessels. Each time, nothing.

Finally, on September 9, 1929, the ship's owners could no longer avoid the inevitable and reluctantly called off the long, fruitless search. After 266 days, East Asiatic announced to the world that the ***København***, with its young passengers, was presumed lost.

A number of theories have been offered to explain why the ship vanished. Some believe that it may have collided with an iceberg when visibility was poor. One leading theory involves a sudden and fatal shift in wind. Retired ex-crewman Captain R. Peter Emdall explains:

"If she [***København***] was hit suddenly by a heavy squall while carrying a full set of sails...then it is quite possible that she could have capsized, not giving her crew any chance to launch the lifeboats."

It must be remembered that for all ***København***'s superb condition and handling, it was travelling light in ballast. According to famed mariner Alan Villiers, "She [the ***København***] did not need to be unstable if she were caught badly by the lee in some violent, sudden shift in wind."

Retired Master Mariner B.L. Butcher in England speaks of the inherent dangers in the Southern Ocean, "...wind and sea sweep along unhindered by any landmass. There the sea can be truly tremendous, and at times confused, so that a ship falling off and losing her wind and steerage way can be quickly thrown on her beam-end, capsize, and quickly disintegrate under the pounding..."

Butcher also writes of the rogue or super wave that can grow to nightmarish proportions and strike without warning: "These walls of water, sweeping along a mile or more in length, offer on their windward side a greater expanse of surface for the wind's driving force. And, it follows, more water will pile up and the speed of the wave will increase. Sheltering as it will the

preceding wave, it subsequently overtakes this second wave which subsides and slows to be eventually consumed. The process continues until eventually the wave grows so immense, towering so high that, top heavy, its crest topples over in a mighty roar, sinking back into the body of the ocean from which it again rises as a commonplace series of storm waves."

Butcher speculates that the ***København*** could have encountered such a wave while running hard before the perennial westerlies. Without any warning, one of these waves would loom out of the night-dark sea astern to overtake the doomed ship at the speed of an express train. Still growing in weight and height, the wave would rush down on the ship, pushing ahead of itself the residue of the preceding wave it was overtaking as it struck.

København's stern or poop would rise vainly as the mountain of water immediately engulfed the ship's after part. Tons of water, bearing down on the poop, would cause the ***København*** to "hog" or arch amidships while being pushed down fore and aft. The backstays or rigging supporting the masts would snap, sending masts, yards, rigging, and sails overboard. The ship, unable to rise again, would be pressed down by the volume and weight of the water passing over. Most on board would never know what happened. Afterwards there would have been no trace of the ***København***'s passing since it was already battened down against the vicissitudes of the high southern latitudes.

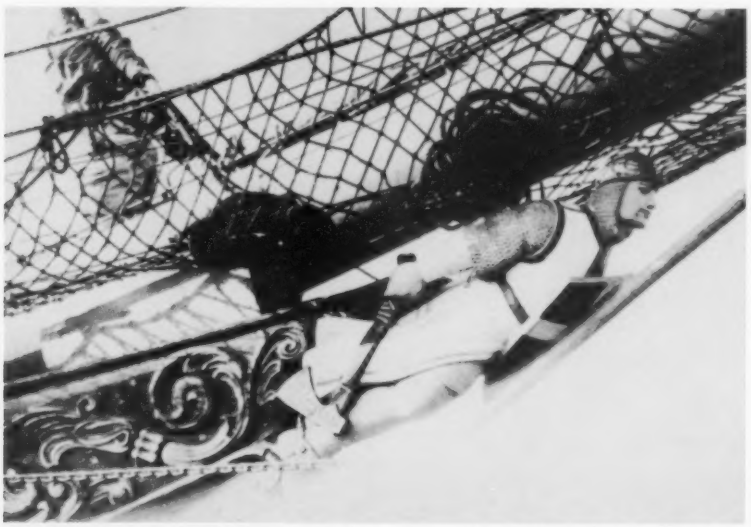
In 1916, Sir Ernest Shackleton, vividly describes his experiecne with a rogue wave in the same area of the South Atlantic. Shackleton writes: "At midnight I was at the tiller and suddenly noticed a line of the clear sky between the south and southwest. I called to the other men that the sky was clearing, and then a moment later I realized that what I had seen was not a rift in the clouds but the white crest of an enormous wave...It was a mighty upheaval of the ocean, a thing quite apart... I shouted, 'For God's sake, hold on! It's got us!' White surged the foam of the breaking surf...We were in a seething chaos of tortured water; but somehow the boat lived through it, half-full of water, sagging to the dead weight and shuddering under the blow. We baled with the energy of men fighting for life, flinging the water over the sides with every receptacle that came to our hands, and after ten minutes of uncertainty we felt the boat renew her life beneath us. She floated again and ceased to lurch drunkenly as though dazed by the attack of the sea. Earnestly we hoped that never again would we encounter such a wave."

Perhaps the best epitaph was given by Mariner Butcher. Butcher recalls a last encounter with the ill-fated ship: "Down in the lonely Roaring Forties, miles from anywhere except the bottom, we were plunging and shivering our way at about 8 knots, lifting our stern to a never ending succession of mighty, ravishing greybeards when, in the morning watch, there appeared out of the murk astern, off our starboard quarter, the upper sails of a windjammer. Steadily it overhauled us, and when abeam, hoisted her pennants to let us know it was the ***København***. Mortified, we acknowledged.

As the afternoon watch drew to an end, her royals were sinking below the forbidding horizon ahead, and it was reckoned it was doing a good 11 knots. She beat us all the way to Australia where we arrived to find her cadets had also beaten us to the pick of Melbourne attractive girls.

"Not many months later she vanished with all hands, somewhere in the vicinity where she had shown us a clean pair of heels. Those greybeards pick their time."

And so, the writer's words about great sailing ships, trailing disaster in their wake, finally came true for the Great Dane, the ***København*** of Denmark.



*The **København** masthead (above) is Absalon, a 12th century Lutheran bishop. He was a friend of King Waldemar of Denmark and was known as the "Warrior Bishop." Photograph courtesy of Edwardes Collection of the State Library of South Australia.*

Hurricane Andrew—

a preliminary look

Ed Rappaport
National Hurricane Center

There have been bigger hurricanes. There have been stronger hurricanes. But no hurricane in history has caused more damage than Andrew. It was a small, ferocious storm that wrought unprecedented economic devastation along a path through the northwestern Bahamas, the southern Florida peninsula, and south central Louisiana. Preliminary damage estimates in the United States range from $15–30 billion, making Andrew the most expensive natural disaster in U.S. history.

The tropical cyclone struck southern Dade County, Florida with violent winds and storm surges characteristic of a category 4 hurricane on the Saffir–Simpson intensity scale. Its central pressure (926 mb) is the third lowest this century for a hurricane at landfall in the United States. In Dade County alone, the forces of Andrew resulted in 15 deaths and one–quarter million people homeless. An additional 25 lives were lost in Dade County from the indirect effects of Andrew, but the total of 40 lives lost there seems remarkably low considering the destruction caused by this hurricane.

The dramatic photograph was kindly sent by Mark Edelson of the ***Sun Sentinel*** *and was taken by Carl Seibert/* ***Sun Sentinel.*** *The photograph is an aerial view of a south Dade County neighborhood, which was devastated by Hurricane Andrew on the 24th of August. The newspaper reports were collected by* ***Mariners Weather Log*** *Florida correspondents Danielle and Ryan Rose.* *See additional information on the pictorial hurricane review prepared by the* ***Sun Sentinel*** *on page 2.*

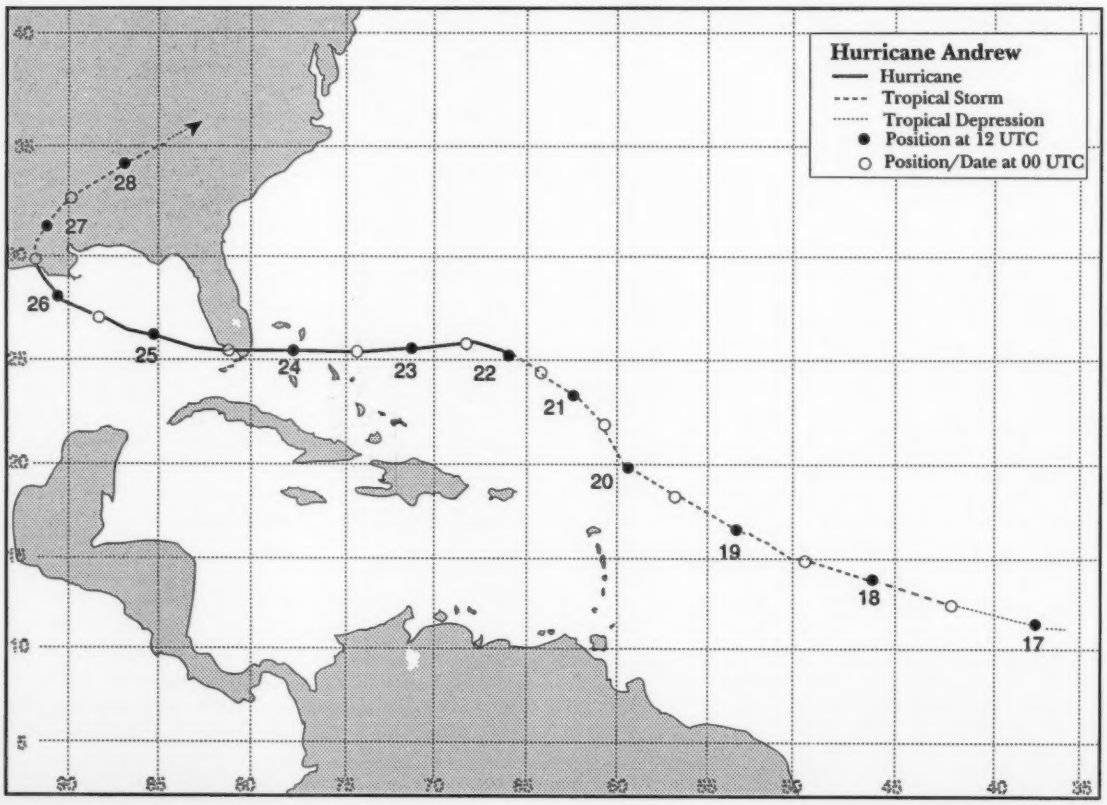
Much of the data for this preliminary summary were provided by reports from the National Weather Service Offices in Miami, Key West, Palm Beach, Melbourne. Tampa Bay, Slidell, Lake Charles, Baton Rogue, Birmingham, Mobile, Beaumont, Jackson, Memphis, Atlanta. Sam Houston of the AOML Hurricane Research Division collected additional observations.

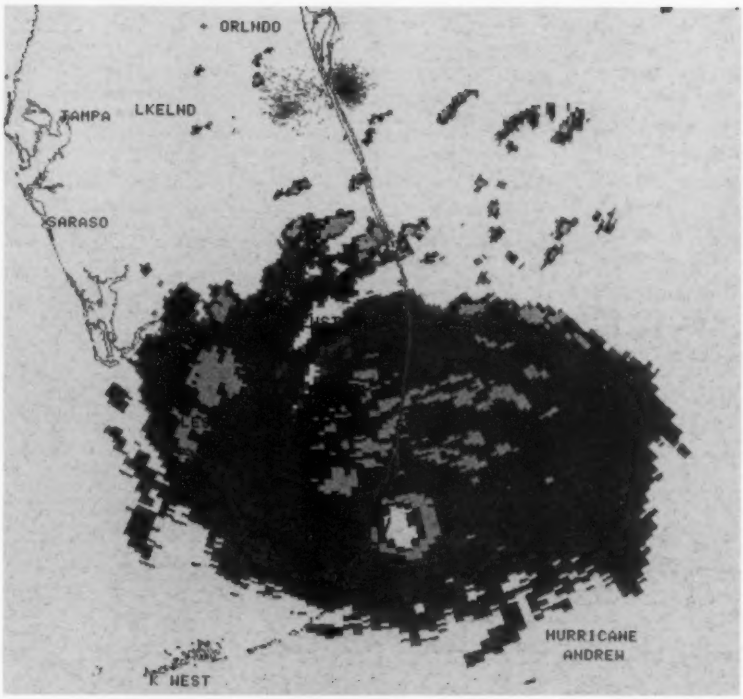
Young Andrew

Hurricane Andrew formed from a tropical wave which satellite pictures and upper-air data indicate moved off the west coast of Africa on August 14 and passed to the south of the Cape Verde Islands the following day. Convection became more focused, narrow spiral-shaped bands of clouds developed around the center of rotation, and a transition from tropical wave to tropical depression took place on the 16th. The depression grew stronger, and at 1200 UTC on the 17th it became Andrew, the first Atlantic tropical storm of the 1992 hurricane season. It continued moving rapidly on a heading which turned from west-northwestward in the general direction of the Lesser Antilles.

Between the 17th and 20th of August, the tropical storm passed south of a High as steering currents carried it closer to a strong upper-level low pressure system centered about 500 nautical miles to the east-southeast of Bermuda with a trough that extended southward for a few hundred miles. These currents gradually changed and Andrew slowed on a course which became northwesterly. They also brought the tropical storm into an environment of strong southwesterly vertical wind shear and quite high surface pressures to its north. Air Force Reserve unit reconnaissance aircraft, on the 20th, found that the cyclone had degenerated to the extent that only a diffuse low-level circulation center remained. Andrew's central pressure had risen considerably. Nevertheless, the flight-level data indicated that Andrew retained a vigorous circulation aloft. Windspeeds were near 70 knots at 1500 feet close to a convective band lying to the northeast of the low-level center. Hence, Andrew is estimated to have been a tropical storm with 40-knot surface winds and an astonishingly high central pressure of 1015 mb on the 20th.

Significant changes in the large-scale environment began on the 21st. Satellite imagery indicated that the Low aloft to the east-southeast of Bermuda weakened and split. The bulk of the Low opened into a trough which retreated northward decreasing the vertical wind shear over Andrew. The remainder of the Low dropped just southwest of Andrew where its circulation enhanced the upper-level outflow over the tropical storm. At the same time, a strong and deep high pressure cell formed near the U.S. southeast coast, and a ridge built eastward from this High with its axis lying just north of Andrew. The associated steering flow over the tropical storm became easterly. Andrew turned toward the west, accelerated to the near 16 knots, and quickly intensified.





Hurricane Andrew as seen by the NEXRAD Radar at Melbourne, Florida on the 24th of August at 0820 UTC. The gradations, which are in color on the screen, indicate varying intensities. In this instance the strongest area is in the northern part of the eyewall and the gray areas north of the center. These represent areas of maximum precipitation intensity. Some of the outer rainbands north of Palm Beach also contains some strong cells. These Doppler radars are also useful in analyzing wind conditions and turbulence in tropical cyclones and other systems. Photograph courtesy of Southern Region, NWS.

Hurricane

Andrew reached hurricane strength on the morning of the 22nd, becoming the first Atlantic hurricane to form from a tropical wave in nearly 2 years. Just 36 hours later, Andrew reached the borderline between a category 4 and 5 hurricane and was at its peak intensity. From 0000 UTC on the 21st to 1800 UTC on the 23rd, the central pressure had fallen by 92 millibars, down to 922 millibars. A fall of 72 millibars occurred during the last 36 hours of that period and qualifies as rapid deepening.

The region of high pressure held steady and drove Andrew nearly due west for 2 ½ days beginning on the 22nd. Andrew was a category 4 hurricane when its eye passed over the northern Eleuthera Island in the Bahamas late on the 23rd and then over the southern Berry Islands in the Bahamas early on the 24th. After leaving the Bahamas, Andrew continued moving westward toward southeast Florida.

Andrew weakened when it passed over the western portion of the Great Bahama Bank and its pressure rose to 941 millibars. However, the hurricane rapidly reintensified during the last few hours preceding landfall as it moved across the Straits of Florida. Radar, aircraft, and satellite data showed a decreasing eye diameter and strengthening eyewall convection. Aircraft data also suggest that the deepening trend continued up to the coast. The eye temperature was at least 1-2° C warmer at 1010 UTC (an hour after the eye made landfall) than it was in the last *fix* about 15 nautical miles offshore at 0804 UTC. It was estimated that the central pressure was 926 millibars at landfall near Homestead AFB, Florida at 0905 UTC (5:05 A.M. EDT) on August 24.

Andrew moved nearly due west when over land and crossed the extreme southern portion of the Florida peninsula in about 4 hours. Although the hurricane weakened about one category on the Saffir-Simpson scale during the transit overland, and the pressure rose to about 950 mb, Andrew was still a major hurricane when its eyewall crossed the extreme southwestern Florida coast.

The first of two cycles of modest intensification started when the eye reached the Gulf of Mexico. Also, the hurricane continued to move at a relatively fast pace while its track gradually turned west-northwestward. As Andrew reached the north-central Gulf of Mexico, the high pressure system to its northeast weakened and a strong mid-latitude trough approached the area from the northwest. Steering currents began to change. Andrew turned toward the northwest and its forward speed decreased to about 8 knots. The hurricane struck a sparsely populated section of the south-central Louisiana coast with category 3 intensity at about 0830 UTC on the 26th. The landfall location is about 20 nautical miles west-southwest of Morgan City.

Andrew weakened rapidly after landfall, to tropical storm strength in about 10 hours and to depression status 12 hours later. During this weakening phase, the cyclone moved northward and then accelerated northeastward. Andrew and its remnants continued to produce heavy rain that locally exceeded 10 inches near its track. By midday on the 28th, Andrew had begun to merge with a frontal system over the mid-Atlantic states.

Maximum Winds

The maximum sustained surface wind speed (1-minute average at 10 meters elevation) during landfall over Florida was estimated at 125 knots (about 145 miles per hour), with gusts at that elevation near 150 knots (about 175 miles per hour). The sustained wind gusts corresponds to a category 4 hurricane on the Saffir-Simpson scale. Locally stronger winds occurred at heights more than 10 meters (about 30 feet) above the ground, such as on taller structures. Several unofficial reports of stronger gusts are being evaluated.

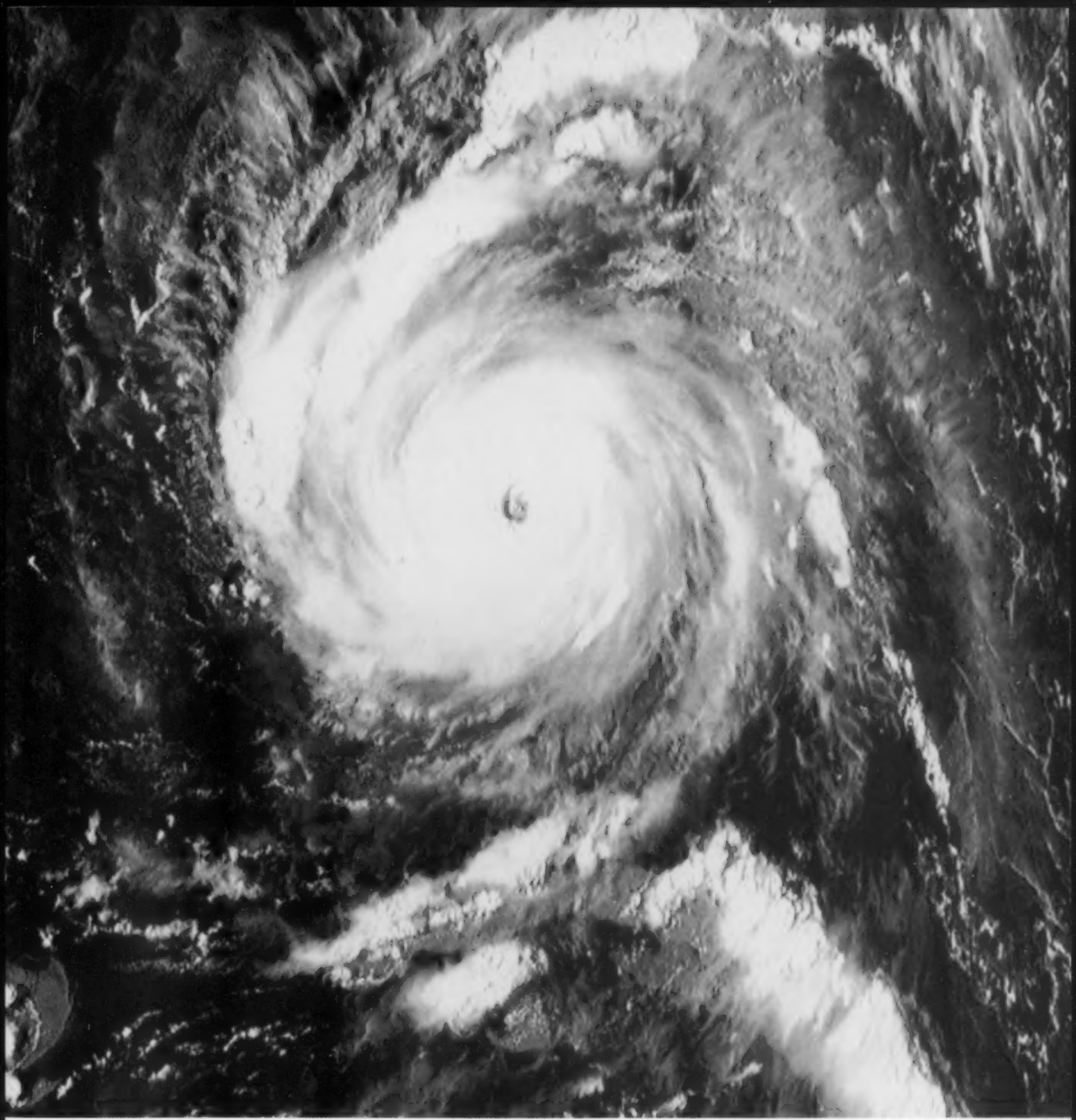
Unfortunately, there were no official observations of sustained surface winds in the region where maximum winds would have occurred at the U.S. landfall sites. However, there is considerable evidence supporting a maximum sustained wind speed of about 125 knots over southeastern Florida. The strongest reported sustained wind near the surface occurred about 1 nautical mile east of the shoreline and, at that time, was sustained wind of 123 knots (141 miles per hour) with a gust to 147 knots (169 miles per hour) at a platform height of 43 meters. The National Data Buoy Center converted this observation to a 2-minute wind of 108 knots (124 miles per hour) at 10 meters elevation using a boundary-layer model. The peak one-minute wind during that period at Fowey Rocks was likely a few knots higher. Moreover, it is unlikely that this point observation was so fortuitously situated that it represents a sampling of the absolute strongest wind. Indeed, Fowey Rocks ceased transmitting data only 3 minutes later, presumably when even stronger winds disabled the instrumentation. A subsequent visual inspection indicated that the mast supporting the anemometer had become bent 90 degrees from vertical.

Reconnaissance aircraft winds at about 10,000 feet are also compatible with a 125-knot estimate. The maximum wind speed along 10 seconds of flight track (equated to a 1-minute windspeed at a stationary site) on the last pass prior to landfall was 162 knots. That wind occurred at 0810 UTC in the eyewall region 11 nautical miles to the north of the center of the eye (almost directly above Fowey Rocks). As with the observation from Fowey Rocks, it must be kept in mind that the aircraft provided a series of *point* observations (i.e., no lateral extent). It is likely that higher windspeeds occurred elsewhere in the northern eyewall, a little to the left and/or to the right of the flight track. A windspeed at 10,000 feet is usually reduced in order to obtain a surface wind estimate. The findings of a preliminary analysis of the aircraft and low-level observations by the Atlantic Oceanographic and Meteorological Laboratory (AOML) Hurricane Research Division was consistent with 125 knots.

Two indirect measures of intensity support a sustained wind speed of at least 125 knots. First, a standard pressure-wind relationship applied to 926 millibars yields around 135 knots (155 miles per hour) Second, a special Tropical Satellite Analysis and Forecast unit Dvorak technique classification at landfall pro-

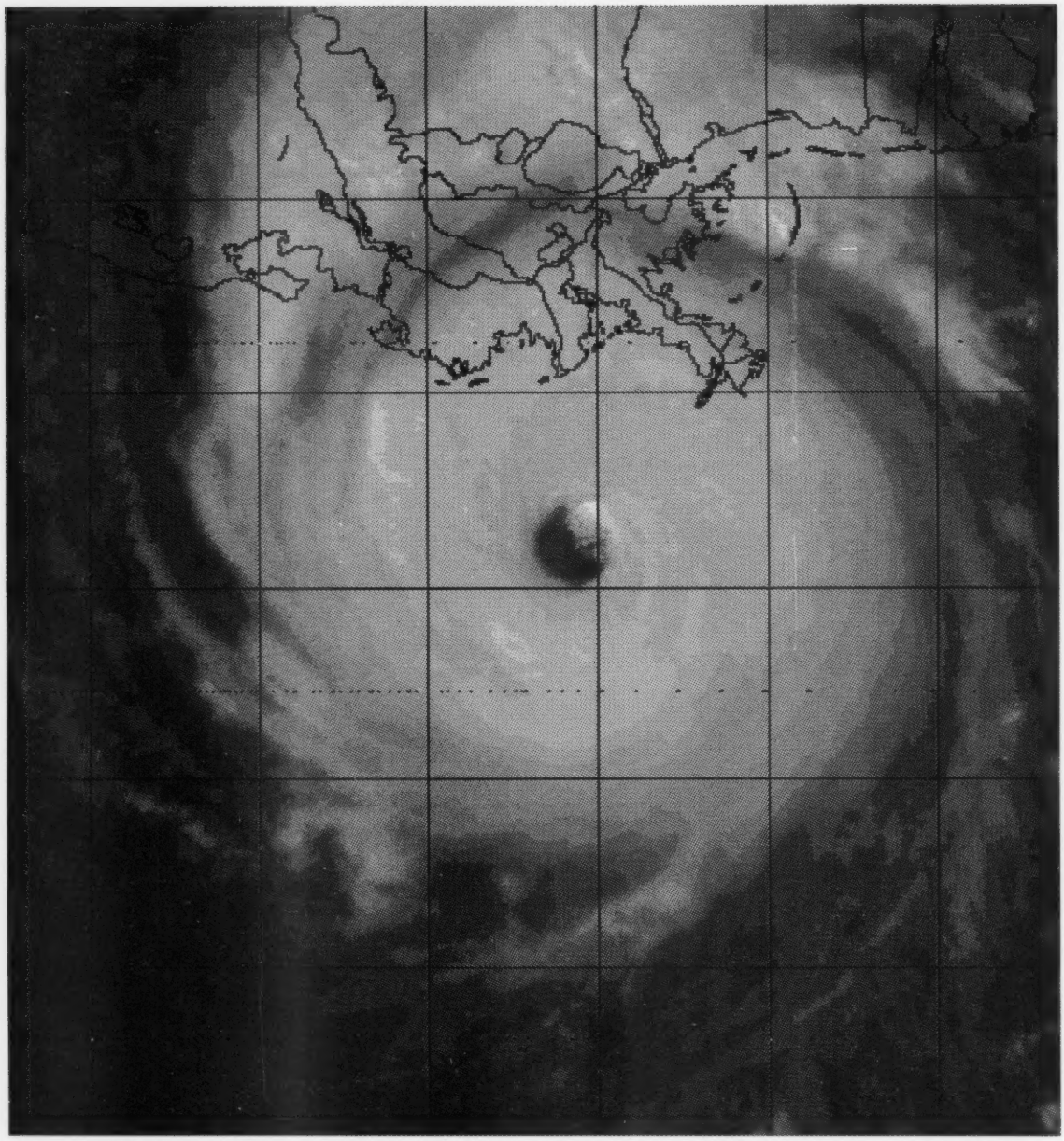
Initial estimates of casualties and damages

	Deaths			Damage
	Direct	Indirect	Missing	($ Billion)
Bahamas	3	1		0.25
Florida				
Dade County	15	25		15-30
Broward County	0	3		0.1
Monroe County	0	1		0.131
Collier County	0			0.03
Louisiana				
St. John the B Parish	2			
Offshore	4		2	
Lafayette Parish				0.017
Vermillion Parish				0.001
Georgia				0.001
Total	**24**	**30**	**2**	**15-30**



Above is a NOAA-11 AVHRR (Advanced Very High Resolution Radiometer) Channel 2 (Near IR) view of Hurricane Andrew on the 24th of August at 2041 UTC. To see where the storm is located, Cuba can be seen in the lower portion of the picture and the Yucatan Peninsula in the lower left corner. In the northeast quadrant of the storm, barely visible in between cloud bands, is the Tampa Bay–St. Petersburg area. The features in the cloud masses that stand out as little bumps are cloud tops that have pushed through the cirrus and usually indicate particularly intense activity. This photograph was generously provided by John Pritchard and Robert M. Carey of NOAA/NESDIS.

At the time of this satellite photograph Andrew was recovering from its trip across Florida and the central pressure was around 945 mb with maximum winds of about 115 knots. The central pressure was near a minimum in the first phase of reintensification. It would later rise slightly and then, on the following day, fall once again as it headed toward the Louisiana coast.



This is a VHRR reflectance (Channel 1) satellite shot from NOAA 11 at 2028 UTC on the 25th of August as the center located south of the Mississippi Delta. At this time the storm was intensifying and its central pressure was falling below 940 millibars while maximum winds were around 120 knots. The center was still about 12 hours from landfall about 20 nautical miles west southwest of Morgan City. This shot was provided by NODC/NCAAS, which is the NOAA CoastWatch Active Access System.

vided a T-number of 6.5, or 127 knots.

It is estimated that maximum gusts (of 3-5 seconds duration) were near 150 knots (175 miles per hour) at the 10-meter level at landfall in Florida. Unofficial observations support locally higher, more instantaneous peak gusts.

Minimum Pressures

Several unofficial pressure observations read at the surface near Homestead support a landfall central pressure of 926 millibars. The observations also suggest that the 932-millibar central pressure report from

Hurricane Andrew Selected Surface Observations

Location	Minimum sea–level pressure: Pressure (millibars)	Minimum sea–level pressure: Date/time (UTC)	Maximum surface wind speed (knots): 1–minute average	Maximum surface wind speed (knots): Peak gust	Maximum surface wind speed (knots): Date/time (UTC)[1]	Storm surge[2] (ft)	Storm tide[2] (ft)	Rain (storm total) (in)
Bahamas								
Harbour Island	935 –	23/2100	120*		23/2100*			
Nassau	999 –	24/0000	80	100	24/0025			
Current Island						23		
Florida								
Miami WSFO/NHC	982 –	24/0900	100*•	142*•	24/0850			
Miami Int. Airport	992.6	24/0900	75#	100#	24/0950			2.04
Tamiami Airport	988 –		50*	70*	24/0833			
Palm Beach	1010.8	24/0259	43	51	24/1033			
Key West	1010.1	24/1400	25	37	24/1614			0.33
Fort Myers	1010.2	24/1347	30	45	24/1446			0.56
Louisiana								
P42 (Morgan City)			80•	94•				
Baton Rouge	996.5	26/1427	42	61	26/1452			5.70
New Orleans	1006.6	26/0805	39	57	26/0950			5.70
Salt Point AMOS			40	72	26/0728			
Lafayette	990.5	26/1250	46	62	26/1057			5.51
Lake Charles	1008.8		21	34	26/2152			0.05
Alabama								
Huntsville	1000.3	27/2250	22	36	27/1742			0.92
Birmingham	1001.7	27/2215	19	35	27/1640			1.77
Montgomery	1008.8	27/2045	23	31	27/2307			1.55
Mobile	1010.1	27/2051	26	35	25/1844			0.64
Mississippi								
Jackson	998.6	26/0750	28	49	27/0219			4.79
Meridian	1004.4		25	48	27/0945			5.29
Texas								
Port Arthur	1011.5	26/1000	22	30	26/1953			
Ship Reports								
OYGK2 (29.5°N, 80.6°W)				60		25/1200		
ELLE2 (19.4°N, 56.6°W)				35		19/1500		
C6KD (28.1°N, 79.2°W)				35		24/0600		
Gulf of Mexico Platforms								
SS 198G			78	100	26/0330			
EC 83H (28.2°N, 92.0°W)			46	49	26/0330			
EC 42B (29.5°N, 92.8°W)			38	88	26/0430			
SM 136B (28.2°N, 92.0°W)			38	44	25/2230			

[1] Time of 1 minute wind speed unless only gust is given.

[2] Storm surge is water height above normal tide level. Storm tide is water height relative to National Geodetic Vertical Datum (NGVD) which is defined as mean sea level in 1929.

Estimated.

• Non–standard elevation.

* Equipment became inoperable after this measurement.

– A more extreme value may have occurred unnoticed.

reconnaissance aircraft 1 hour prior to landfall came from a dropsonde that probably did not sample the lowest pressure with the eye. In this century, only Camille in 1969 and the Labor Day (Keys') Storm in 1935 had lower pressures at the time of landfall in the United States.

Storm Tides

Andrew came ashore in the northwest Bahamas and southeast Florida near high tide and was accompanied by a locally huge storm surge. The surge at Current Island, near the northern end of Eleuthera Island, reached a phenomenal 23 feet. The 16.9-foot storm tide which headed inland from Biscayne Bay is a record maximum for the southeast Florida peninsula. Storm tides in Louisiana were at least 7 feet and caused flooding from Lake Borgne westward through Vermillion Bay. Results from storm surge surveys in southwest Florida were incomplete at the time of this writing.

Tornadoes

There have been no confirmed reports of tornadoes associated with Andrew over the Bahamas or Florida. Funnel sightings, some unconfirmed, were reported in the Florida counties of Glades, Collier and Highlands, where Andrew crossed in daylight. In Louisiana, one tornado occurred in the city of Laplace several hours prior to Andrew's landfall. That tornado killed 2 people and injured 32 others. Tornadoes in the Ascension, Iberville, Baton Rouge, Pointe Coupee, and Avoyelles parishes of Louisiana reportedly did not result in casualties. Numerous reports of funnel clouds were received by officials in Mississippi and tornadoes were suspected to have caused damage in several Mississippi counties. In Alabama, the occurrence of two damaging tornadoes has been confirmed over the mainland while another tornado may have hit Dauphin Island. As Andrew and its remnants moved northeastward over the eastern states, it continued to produce severe weather. Several damaging tornadoes in Georgia late on 27 August were attributed to Andrew.

Rainfall

Rains from Andrew caused local floods even though the hurricane was relatively small and generally moved rather fast. Rainfall totals in excess of 7 inches were recorded in southeast Florida, Louisiana, and Mississippi. Rainfall amounts near 5 inches occurred in several neighboring states. Hammond, Louisiana reported the highest total, 11.92 inches.

Death and Damage

The death toll from Andrew currently stands at 54. Damage estimates are fluctuating within the $15–30 billion range. Andrew's impact on the southern Dade County was extreme from the Kendall district southward through Homestead and Florida City, to near Key Largo. Insured losses alone in southern Florida have been preliminarily estimated at $7.3 billion by the Property Claims Division of the American Insurance Services Group, Inc. Recent news reports indicate that this total may rise. The damage to Louisiana was estimated at $1 billion. While damage in the Bahamas has been estimated at $0.25 billion. Extensive damage occurred to numerous offshore platforms near the south-central Louisiana coast.

Hurricanes are notoriously capricious. Fortunately, Andrew was compact. A little larger system or one making landfall just a few miles farther to the north, would have been catastrophic for heavily populated, highly commercialized and no less vulnerable areas which include downtown Miami, Miami Beach, Key Biscayne and Fort Lauderdale. Andrew also left highly vulnerable New Orleans relatively unscathed.

Forecasts and Warnings

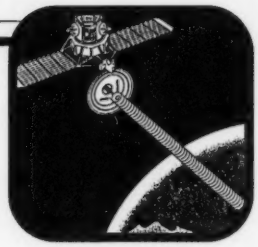
Massive evacuations were ordered in Florida and Louisiana as the likelihood of Andrew making landfall in those regions increased. About 55,000 people left the Florida Keys. Evacuations were ordered for 517,000 people in Dade County, 300,000 in Broward County, 315,000 in Palm Beach County and 15,000 in St. Lucie County. For counties farther west in Florida, currently available evacuation totals exceeding one thousand people were Collier (25,000), Glades (4,000) and Lee (2,500). It is estimated that 1,250,000 people evacuated from parishes in southeastern and south-central Louisiana. About 250,000 people evacuated from Orange and Jefferson Counties in Texas. The recovery process continues in several areas. Nevertheless, it is not too early to emphasize an important point. The winds in Hurricane Andrew wreaked tremendous structural damage, particularly in southern Dade County. Notwithstanding, the loss of life in Hurricane Andrew, while very unfortunate, was far less than has previously occurred in hurricanes of comparable strength. Historical data suggests that storm surge is the greatest threat to life. Clearly, lives were saved by the large evacuation along the coastline of southeast Florida. The relatively small loss of life there serves as testimony to the success and importance of coordinated programs of hurricane preparedness.

Hurricane Andrew selected NDBC observations, August 1992

	Minimum sea-level pressure		Maximum wind speed (kt)		
Platform/Location	Pressure (mb)	Date/time (UTC)	Avg.*	Peak gust	Date//time (UTC)
Fowey Rocks C–MAN FWYF1 / 25.6°N 80.1°W	967.5**	24/0800	123**	147*	24/0800
Bullwinkle Platform BUSL1 / 27.9° N 90.9°W	998.5	25/2300	52	63	25/2200
Molasses Reef C–MAN MLRF1 / 25.0°N 80.4°W	998.5	24/0900	48	56	24/1000
Eastern Gulf Buoy 42003 / 25.9°N 85.9°W	1000.5**	25/0200	45**.	56**	25/0200
Grand Isle C–MAN GDIL1 / 29.2°N 89.9°W	1005.2	25/2300	48	59	25/2200
Southwest Pass C–MAN BURL1 / 28.9°N 89. 4°W	1006.1	25/2200	56	64	25/2100
Sombrero Key C–MAN SMKF1 /24.6° N 81.2 W	1007.7	24/1100	34	39	24/1130
Lena Platform C–MAN LNEL1 / 28.2°N 89.1°W	1007.7	25/1600			
Eleuthera Buoy 41016 / 24.6°N 76.5°W	1007.9	23/2100	29	35	24/0100
Sand Key C-MAN SANF1 / 24.5°N 81.9°W	1010.2	24/1100,1400	30	35	24/1600
Settlement Point C–Man SPGF1 / 26.7°N 79.0°W	1012.7	24/0600	38	44	24/0500
Dauphin Island C–MAN DPIA1 / 30.2° N 88.1°W	1016.1	26/0000	32	38	25/2100

* NOAA buoys report an 8–minute average wind. C–MAN stations report a 2-minute average wind at the top of the hour and 10–minute averages at other times.

** Equipment became inoperable shortly after observation.



CoastWatch and Andrew

Pablo Clemente–Colon
National Environmental Satellite, Data, and Information Service

CoastWatch, a component of NOAA'S Coastal Ocean Program, is monitoring coastal marine regions in support of environmental science and decision making. Satellite imagery products are derived from the Advanced Very High Resolution Radiometer (AVHRR) aboard the polar orbiting NOAA–series satellites. These products are mapped for over 35 CoastWatch regions and subregions. The images are archived by the National Oceanographic Data Center (NODC) and are available electronically to authorized users.

The images presented here are examples of the South Florida CoastWatch region data. These images were produced by subtracting the albedos from the AVHRR visible channel–1 image (0.58-0.68 μm) and channel–2 image (0.725–1.10 μm). The albedo is the ratio of reflected solar radiation over incident solar radiation. Clear oceanic waters do not reflect as much visible incident solar radiation as turbid or shallow coastal waters do. The albedo difference allows for some atmospheric effects to be removed from the images and highlights turbidity patterns on the scenes. Land and clouds are shown as black with some cloud contamination appearing as grey throughout the images shown.

The first image is a composite of data from July 31 and August 1, 1992 showing typical turbidity conditions in the region. The dark grey band over the lower right of the image indicates the clear waters of the Gulf Stream. Lighter grey areas at both sides of this band indicate the shallow depths (i.e. bottom reflection) and normal coastal turbidity processes. The second image shows conditions immediately after the passage of Hurricane Andrew over the area on August 25, 1992. Large regions of high turbidity are now apparent in the Bahamas, the upper Keys, and South Florida's West Coast.

The observed increase in coastal turbidity is due to a large extent to the stirring of bottom sediments by the passage of the hurricane. Most of the sediments in this region are composed of sand, sand–gravel, and/or shell. Still, terrigenous material as well as drift algae and sea grasses can be contributing significantly to the observed turbidity.

Reports from the ground agree with observations of turbidity in the Florida Bay. Aerial surveys found western Florida Bay milky with suspended sediments while other parts of the Bay were fairly clear. The effects of suspended sediments were also observed around the upper Keys where some of the coral reefs were in the direct path of the hurricane. Preliminary examinations of the reefs have shown considerable damage but not as extensive as expected considering the strength of Andrew. Apparently, the fast translation of the hurricane did not allow for a sustained pounding of the corals. On the other hand, intact coral skeletons were observed to be completed voided of polyps. The excess content of suspended sand in the water may in fact have literally *sandblasted* them.

The most intense turbidity signals were produced under the path of the hurricane. In addition, a large turbidity pattern developed over the west Florida platform extending north to the Charlotte Harbor area and west 40 to 50 miles from the coast. The offshore extending feature represents the advection of shelf waters by prevailing circulation regime.

For more information on CoastWatch retrospective data, please contact:
National Oceanographic Data Center
User Services Division
1825 Connecticut Avenue, N.W.,
Washington, D.C. 20233

Hurricane Legacy

Justin Kenney
National Ocean Service

A hurricane is one of the most serious threats nature imposes on coastal waters. The National Marine Sanctuaries, acting as living laboratories for the study of marine ecosystems, are especially valuable in providing research on the effects of storms on vulnerable marine havens. Within hours a major hurricane can inflict damage to coral reefs that may take centuries to repair. Severe damage can even wipe out a reef, as occurred with Hurricane Hattie in Belize (October 1961) and Hurricane Allen in Jamaica (August 1980).

When the National Weather Service upgraded Hurricane Andrew to a Class 5 hurricane, traffic on Route A1 was clogged for miles as families heeded warnings to evacuate the Florida Keys. For the staff of the Florida Keys, Looe Key, and Key Largo National Marine Sanctuaries, the days prior to the arrival of the hurricane was a time to store boats, secure belongings, and get out of town.

Andrew's path of destruction was later compared to a 20-mile wide tornado which may flatten buildings and uproot vegetation on one side of a road while the area across remains relatively untouched. For many in Andrew's path, normal lives will not return for months, if at all.

Understandably, the media focuses on the human dimension of hurricanes—the number of fatalities, relief efforts, property damage assessments—and tends to overshadow the less obvious but potentially longer lasting damage to coastal ecosystems. For the coral reefs of the Florida Keys, it appears they escaped much of the potential destruction of Andrew's storm surge. However, coral reefs located at the northern tract, where the eye of the hurricane passed, were not so lucky.

Sanctuary staff and the Florida Department of Natural Resources surveyed the waters at Triumph Reef in the Northern Keys and found damage similar to that on land—patches of coral severed and scarred next to others that remained untouched. Here Andrew's storm surge turned brain corals into underwater wrecking balls and broken elkhorn branches into destructive projectiles.

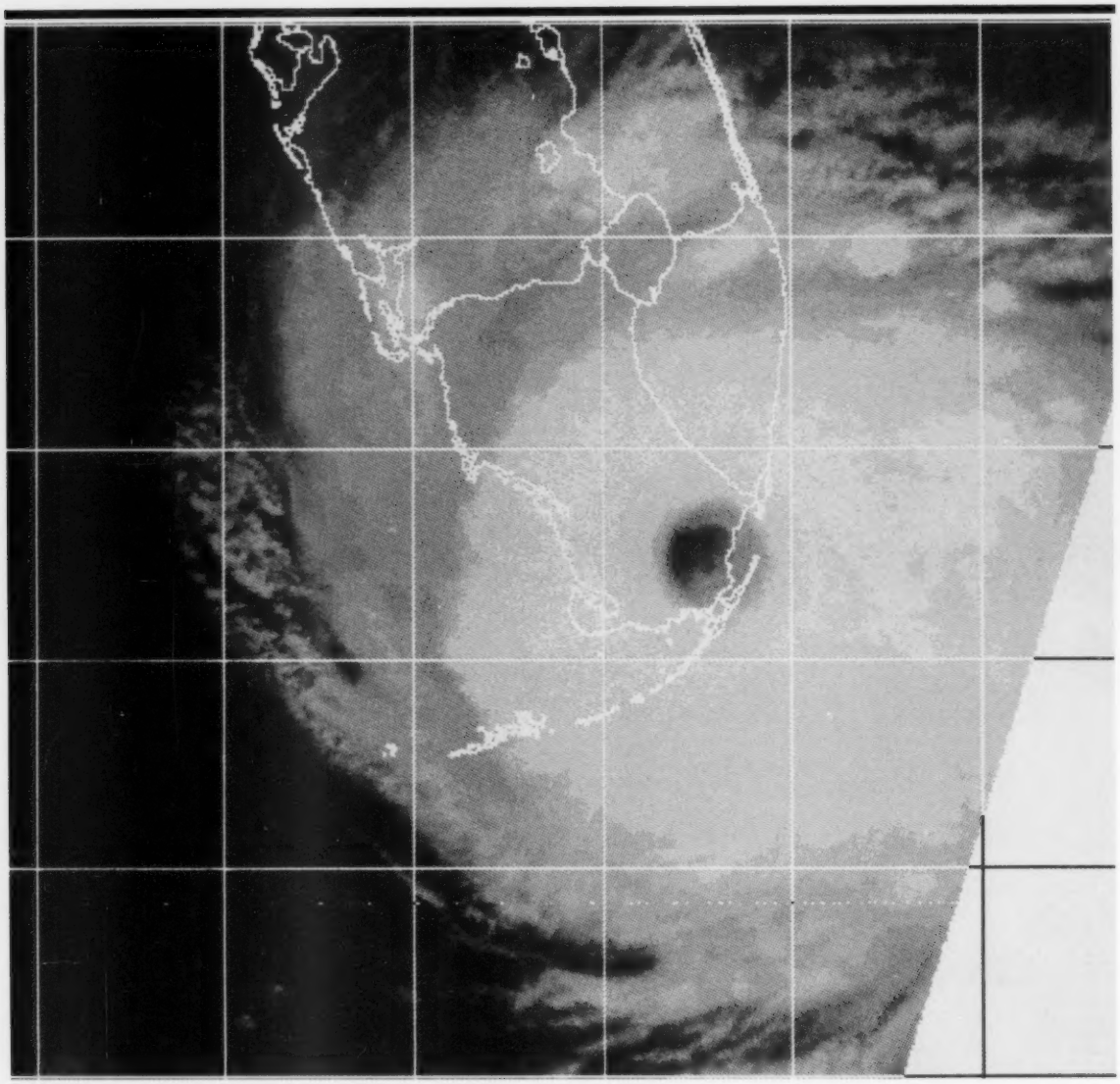
In the aftermath of Hurricane Andrew, sanctuary mangers and scientists have an opportunity to monitor the impact of hurricanes on coral reef systems and to answer important questions. Does periodic hurricane damage have only negative effects on the health of a reef, or can it actually stimulate growth and create greater diversity? Can a hurricane be compared to the function natural forest fires serve in clearing new areas for growth? In the case of forest life, the jack pine requires the intense heat of a fire to melt the wax of its cones and release the enclosed seeds.

Although the coral reef does not have its jack pine, there is evidence that moderate hurricane damage can benefit certain opportunistic species. Broken or dislodged staghorn and elkhorn corals

Hurricane Allen generated a dangerous storm tide along the coast of Jamaica in August of 1980. This shot was taken at Discovery Bay, Jamaica and the wave was estimated to be at 30 feet. Note the height of the houses in the foreground. After Allen moved into the Gulf of Mexico it became a Category 5 hurricane with estimated maximum sustained winds of 165 knots and a minimum central pressure of 899 millibars. By comparison, Andrew's minimum pressure was estimated at 923 mb on the 23rd of August. A large collaborative research effort was undertaken to document the damage and recovery since 1981 in Jamica. This exceptional photograph is courtesy of Dr. Charles M. Wahle, of the Policy Coordination Division of NOAA.

may reattach and asexually repopulate the colony. Newly exposed rocky substrate can in turn provide a home for other corals, sponges, and sea fans. Diversity in coral reefs has been attributed by some to periodic moderate storm damage and the resulting recolonization and recovery that follows a storm. Slow growing corals that would otherwise be at a relative disadvantage to faster growing corals appear to be better suited to surviving storm surges and can prosper over time.

As a result of Hurricane Val, the Fagetele Bay National Marine Sanctuary is already studying hurricane damage and the ability of a coral reef ecosystem to recover. In December 1991 Val with winds reaching over 100 miles per hour battered American Samoa. As a result, President Bush declared the islands a national disaster area. Fagatele Bay, a one-quarter square nautical mile tropical reef located off southern Tutuila Island, sustained considerable damage to its already vulnerable reef. In the late 1970s, Fagatele Bay was the site of a different natural disaster–a near total destruction of the coral reef by crown-of-thorns starfish. The resulting survey and monitoring activities after the attack gave sanctuary staff a foundation for conducting a study of hurricane damage and recovery. The work under way at Fagatele Bay is important to understanding the natural recovery of a damaged ecosystem.



Hurricane Andrew is seen here by the NOAA 11 Satellite at 0916 UTC on the 24th of August. In this view the gradations from black to gray represent temperatures reflected from the cloud tops and measured by very high resolution radiometer. The darker areas represent the warmer temperatures. At this point the eye is moving in on the coast of Florida. The photograph was provided by the NODC/NCAAS (NOAA CoastWatch Active Access System).

Often the ability for ecosystem recovery is complicated by human activities. Triumph Reef's recovery will no doubt be aggravated by the effects of coastal runoff, cumulative damage from diver activity, and damage caused by debris from groundings. Monitoring the recovery of the Florida Keys and the relatively pristine Fagatele Bay will point to ways that human activities hinder the ability of an ecosystem to recover.

With population growing along our coasts, monitoring the effects of natural phenomena and human activities becomes critical to marine research.

When it's done holding your ship's garbage, it could hold death for some marine animals.

This plastic trash bag may not look like a jellyfish to you. But to a hungry sea turtle, it might. And when the turtle swallows an empty bag, the mistake becomes fatal.

The problem is more than bags. Plastic six-pack holders sometimes become lodged around the necks and bills of pelicans and other seabirds, ultimately strangling or starving them. Other plastic refuse, either through ingestion or entanglement, causes the deaths of thousands of seals, whales, dolphins and other marine mammals every year.

Plastic debris also causes costly and potentially hazardous delays to shipping when it fouls propellers or clogs intake ports.

It's a critical issue, destined to attract public and government scrutiny if we fail to take action to solve it.

So please, stow your trash, and alert your shipping terminals that you will need proper disposal on land. A sea turtle may not know any better. But now, you do!

To learn more about how you can help, write: Center for Marine Conservation, 1725 De Sales Street, N.W., Suite 500, Washington, D.C. 20036.

A public service message from:
The Center for Marine Conservation
The Natural Oceanic and Atmospheric Administration
The Society of the Plastics Industry

Don't Call Me Ernie!

Elinor DeWire
Mystic Seaport Museum

Hardly a lighthouse exists that does not have a supernatural story to tell. Perhaps because lighthouses often stand watch in remote and dangerous places and are sometimes the site of tragedy, we think of them as ideal haunts. The actual physical aspects of a lighthouse make it incredibly eerie—its sheer height, spiral staircase with attendant echoes, the piercing beacon, and the fickle sea at its base. Then too, there are events that leave an indelible mark on the tower's history: war, storms, shipwrecks, and the lives of people who tended it. All these things combine to make lighthouses considerably more vulnerable to hauntings—real or imagined.

"Lots of people come out here and laugh about Ernie. But then crazy things start happening. Stuff gets mysteriously moved, tools disappear, and there's a presence like someone is watching you all the time. I know he's real. All these strange things couldn't be my imagination"

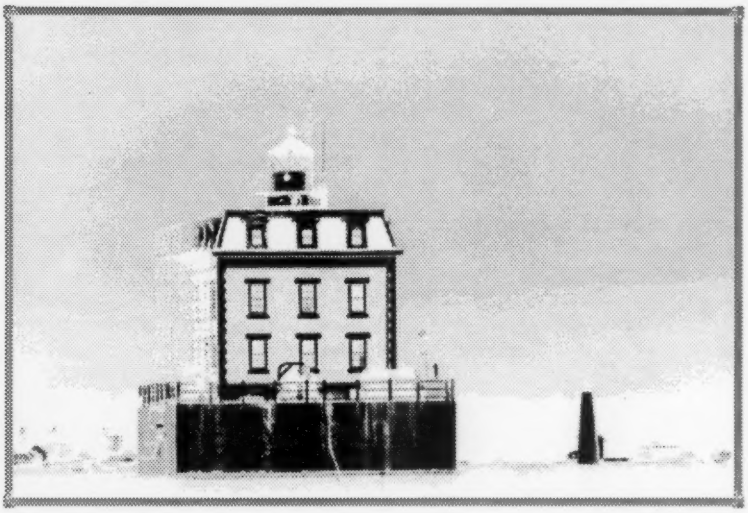
The Coast Guard attendant at New London Ledge Lighthouse preferred not to be named because "people will just think I'm nuts." But he's not alone in his belief about Ledge Lighthouse. Dozens of people, from keepers to local fishermen to casual visitors have met the famous ghost of this handsome brick sentinel perched on a square caisson about a mile off New London, Connecticut. Some years back, the spectre was given the name Ernie. A 1981 seance failed to persuade Ernie to find other lodgings, but he did give his correct name: John Randolph.

Records are scant, but it appears Randolph was one of the station's early keepers. Not everyone was cut out for this monotonous and lonesome vigil and his unhappy wife resented her forced confinement on a dismal hunk of concrete within sight of the pleasures of city life. She began flirting with the harbor pilots and fishermen who traveled in and out of New London Harbor, and before the keeper realized what was happening, she ran away with one of them. Unable to bear the loss, Randolph cut his throat and fell from the top of the 65-foot lighthouse.

Immediately, there were reports of strange happenings at Ledge Light by its new keeper. A sudden waft of cold air would blow out a kerosene lamp; a fishy smell could not be washed away from a room upstairs; doors would slowly open and close. There was never any violence, and at first, no one thought to blame the ghost. By the time the Coast Guard took over the lighthouse in 1940, its ghost was well-known and called Ernie.

Ernie seemed to delight in moving things around, especially in the room where he had slept. Occasionally, his footsteps were heard tiptoeing about. Only when

This Halloween treat is an excerpt from a chapter in Elinor De Wire's forthcoming book about lighthouse keepers, their families and their experiences. Her current book - entitled ***A Guide to Florida Lighthouses*** *is still available from Pineapple Press.*



U. S. Coast Guard

New London Ledge Lighthouse was the haunt of a ghost named Ernie. He evidently didn't like his nickname, because he eventually revealed his real name.

someone expressed doubt about his existence did Ernie become vexed. Once, some fishermen stopped by the light for coffee and told the keepers they thought the ghost was a hoax. When they were ready to leave, they found their boat had been set adrift. Since all the keepers had been inside with the fishermen, it was decided Ernie was to blame. So insulted by their doubts, he had cast off their boat.

A curious thing about his ghost is that only women and children have actually seen him. A keeper's wife in the 1930s claimed to have awakened one night to find a tall, bearded man in a slicker standing at the end of the bed. He lingered a moment, then dissolved away. Her children also saw the man in their room. One Coast Guard keeper believes Ernie spoke to him. Otherwise, Ernie preferred to travel unnoticed about the lighthouse. As late as 1987, there were still reports of Ernie activities.

Quite a different tale is told about Maine's Sequin Lighthouse, perched 180-feet above sea on an island at the mouth of the Kennebec River.

One of the first keepers of the beacon came to the island with his wife, a woman of delicate health. The persistent fogs at Sequin depressed her, and when they cleared she would stare across at the mainland for hours on end.

To assuage his wife's torment, the keeper went ashore one day and bought an old upright piano. When it arrived she began playing almost at once, but to her dismay, she found only one sheet of music. Unable to improvise, she played that one song repeatedly. Yet even after her husband brought new sheet music back to the island, she continued to play that one song—over and over again. The keeper realized his wife was slowly going mad. She had become a near skeletal figure, bent over the piano, wild-eyed and disheveled, she'd play her song as if her fingers were drawn to the keys by some fiendish force. As the weeks passed, residents along the shore could not help hearing the piano on Sequin Island. When the wind was right, the haunting melody wafted across the water. And then, one night it stopped. The cessation of song was so abrupt and unexpected, it frightened the shore listeners, and with good cause. The keeper, himself driven to madness by the infernal song, had strangled his wife.

In October of 1770 the 20-gun frigate *HMS Carrysford* wrecked on the Florida Reef some six miles off Key Largo. It was not the first vessel to go down here, nor would it be the last. Early on, the waters around the Florida Keys had earned the name *Graveyard of the Atlantic.*

The government twice tried to anchor a lightship on the site of the Carysfort's Reef, a corruption of the name *Carrysford.* But in 1848 a better solution was found. A huge iron lighthouse, its legs screwed firmly into the coral, was built on the reef.

Carysfort Reef Lighthouse flashed on in March 1852. When hot weather arrived a few weeks later, its keepers were horrified to discover something not human inhabited the tower.

The day had been exceptionally hot, so when the cool evening breezes blew over the reef, the exhausted keepers set the light and took their watches. One took his turn in the room just below the lantern while the other two went to bed until their time to watch. As darkness enveloped the reef and cool air began to wind its way through the iron legs of the lighthouse, a low groan echoed up the stair cylinder, grew louder, then ended in a piercing screech.

The sound sent the watch-

Elinor De Wire

Lighthouses are natural settings for supernatural events and the variety of weather that occurs along the coasts adds to the atmosphere.

man scurrying about and awoke those sleeping. To all three men it seemed as if the Prince of Darkness—old Lucifer himself—had joined them. There was no sleep for anyone the rest of the night as the screams continued to vibrate up and down the tower's iron joints.

Only a few nights later the same ordeal was repeated, and it happened again and again throughout the summer. When fall arrived, the sounds gradually subsided, but not before several keepers had come and gone. Some grew accustomed to it, always knowing it would cease when cooler weather arrived.

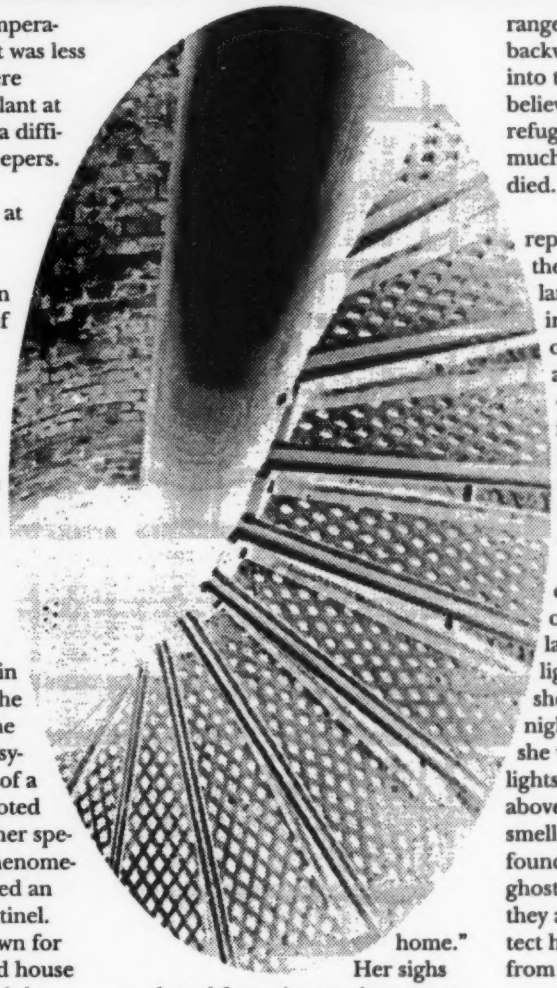
Armed with that bit of knowledge, it's surprising that no one thought to look for the cause in the tower itself. Instead, the noises were blamed on the ghost of Captain Johnson who had died at the lighthouse shortly after its construction. He was said to have been a great sinner, who when unable to secure a place in heaven, was doomed to roam the reef and haunt the tower where he died. Everyone accepted this explanation until 1927. Charles Brookfield had been fishing near Carysfort Light and was invited to dinner by its keepers. He ended up staying the night. A short time after he went to his room, a low moan began in the lower part of the lighthouse He bolted from his bed at the first earsplitting scream and ran up the stairs ran to the watchroom where he found the head keeper unruffled by the noise. The embarrassed Brookfield asked if the keeper had heard any strange noises.

The keeper recounted the whole tale of Captain Johnson. Brookfield was not one to believe in supernatural beings, but he had to admit the sounds were remarkably human. After several hours of discussion with the head keeper and reassurances that Captain Johnson was a harmless spirit, Brookfield retired and tried to sleep.

The ghost tale preoccupied Brookfield and it wasn't long before he pieced together the mystery.

On hot summer days, the metal tower expanded with the extreme heat. As evening temperatures dropped, the metal plates of the tower began to contract and its joints groaned to accommodate them. This expansion-contraction produced the groans and screech-

es. In winter, when the temperature between day and night was less pronounced, no sounds were heard. Brookfield was jubilant at this discovery; still, he had a difficult time convincing the keepers.



The old lighthouse at Point Lookout, Maryland once served as a beacon guiding traffic in and out of the Potomac River, but today it's only a daymark whose walls show signs of age and neglect. In 1987 the 150-year-old beacon became the first lighthouse in the U.S. to have its ghosts formally investigated by a team of eminent psychic researchers.

Persistent reports in the 1960s and 1970s of unexplainable happenings in and around the tower led the state to enlist the help of the Maryland Committee for Psychic Research. Composed of a parapsychologist, several noted mediums and a photographer specializing in supernatural phenomena, the committee conducted an investigation of the old sentinel. Dr. Hans Holtzer, well-known for his inquiry into the haunted house in Amityville, New York, led the team. Holtzer describes Point Lookout Lighthouse as "quite haunted."

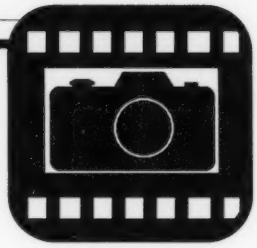
Among the ghostly inhabitants is a woman dressed in a long blue skirt and white blouse often seen standing at the top of the lighthouse stairs. Rangers at Point Lookout State Park believe her to be Ann David, the wife of the first keeper and keeper herself for 30 years after her husband's death. A female voice the research team taped in 1980 on the tower stairway is also believed to be Ann. She tells intruders the lighthouse is "my home." Her sighs are heard from time to time, especially during evening hours. The beacon was abandoned years ago, and rangers believe Ann is upset that it no longer functions.

In December 1977 a resident park ranger met another of the lighthouse ghosts--Joseph Haney. Second officer aboard the steamer ***Express,*** Haney drowned in an 1878 storm and his body washed up near Point Lookout. The ranger spied his ghost peering in the lighthouse's backdoor one evening as a storm approached. He wore the same clothes he had on the day of his death. When the ranger opened the door, he drifted backwards and seemed to dissolve into the porch screen. Psychics believe Haney's ghost sought refuge from the storm, a storm much like the one in which he died.

There have been still more reports of ghosts in other parts of the lighthouse, especially the cellar and one room upstairs. During the Civil War, Point Lookout was the site of a hospital and prison camp and some 4,000 soldiers are buried on its grounds. In addition, there have been several shipwrecks nearby, so it is not surprising to find a few unsettled spirits still clinging to the shores.

Perhaps the most extraordinary supernatural event occurred to a State of Maryland employee who lived in the lighthouse. The woman said she felt at ease with ghosts. One night after she had gone to bed, she was awakened by a ring of lights whirling around the ceiling above. A moment later she smelled smoke, ran downstairs and found a fire. She never saw the ghost lights again, but she believes they appeared intentionally to protect her and to keep the lighthouse from burning down.

Point Lookout Lighthouse hasn't shone a beacon since 1905, and no one has lived in it for a number of years. In fact, the Navy had plans to raze the lighthouse and build a helicopter pad in its place until a group formed to rescue the historic tower. Spared the wrecking ball, the lighthouse still stands. Without a beacon, it's often mistaken for an abandoned old house, and it is looks every bit as haunted as the Maryland Committee for Psychic Research claims it to be.



Lifeboat Drill

Michael Halminski

There was so much interest in the lifeboat drill that takes place every year at Chicamacomico that I asked Michael to give us a brief rundown on the presentation. –ed.

The waters off the North Carolina coast have a reputation as being one of the most treacherous in the world. There have been hundreds of documented shipwrecks along with countless numbers of lives lost.

It wasn't until the 1870s that the federal government established the United States Lifesaving Service along the Outer Banks. At one time there were 29 stations built along the coast to aid mariners in distress.

One of these stations was Chicamacomico. Decommissioned in 1954, the station is located about 25 miles up the north side of Cape Hatteras in the village of Rodanthe. Currently undergoing restoration, the station is also used as a museum of the U.S. Lifesaving Service. Inside the main building are photographs, memorabilia, and other artifacts pertaining to the Lifesaving Service and the early Coast Guard. But by far the most popular exhibit is the living history performance of a shipwreck rescue drill using 19th century beach apparatus.

Rescues were generally made in one of two ways: either with a surfboat, or if the vessel was close to shore, with a rescue device called a breeches buoy, a life ring with trouser legs. To use this device required a bronze cannon called a Lyle Gun. The gun would fire an 18-inch projectile or "shot" over the shipwreck. Depending on the amount of black powder charge, the range could go as far as 500 yards. Attached to the shot was a long cord called a shot line. When the shot line reached the ship, a hawser was drawn out to the vessel and secured to the wreck. Under the hawser rode the breeches buoy. One shipwreck victim at a time would ride ashore and then the breeches buoy was sent back for the next person.

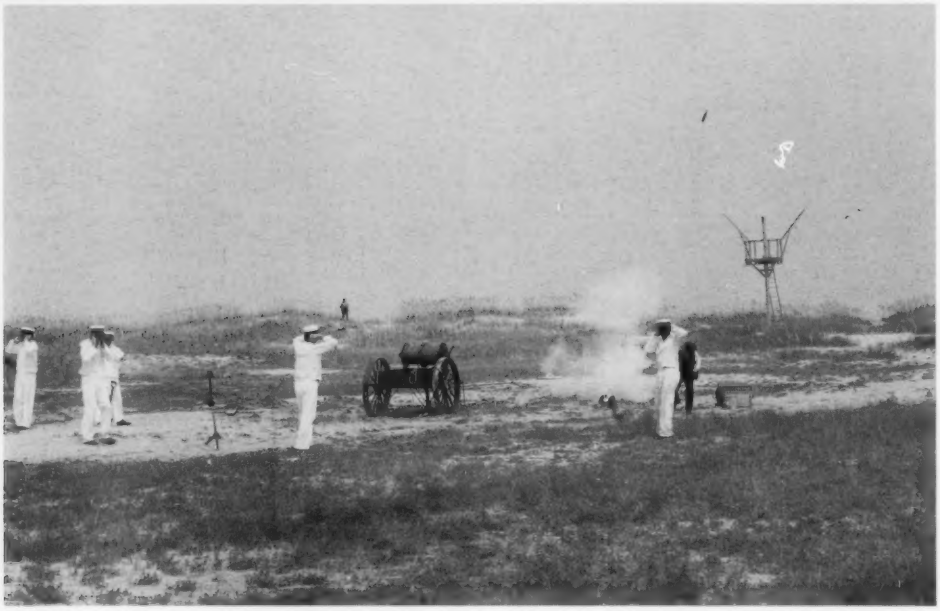
As one of the routine duties of the keeper and surfmen, the beach apparatus drill was performed with precision every Thursday, just to keep in practice. It is said that a good crew could execute the drill in as little as 5 minutes.

The National Park Service first performed this drill as a part of a living history program in the 1970s. It was discontinued for a time, but due to popular demand, the beach drill was reintroduced in the summer of 1983. The historic Chicamacomico Lifesaving Station was chosen as the drill site, at the time the station was in its early stages of restoration under the ownership and guidance of the Chicamacomico Historical Association.

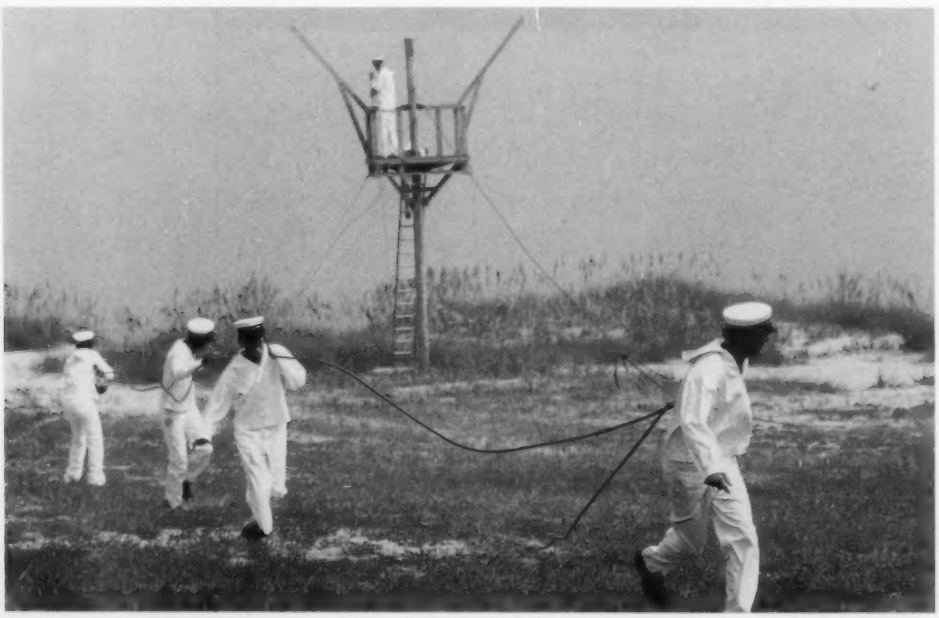
Today, the Beach Apparatus Drill is the mainstay of the living history efforts of the National Park Service in the Cape Hatteras National Seashore. Their 1-hour long program is free and open to the public. It is traditionally performed every Thursday afternoon throughout the summer months, and it has been enjoyed by several thousand spectators each season. Many return year after year and keep up-to-date on restoration efforts. For further information on the schedule and the restoration write:

Chicamacomico Historical Association, Inc.
P.O. Box 5
Rodanthe, NC 27968

The Keeper (played by Steve Ryan, above) demonstrates the use of the Lyle Gun. He is assisted by eight surfmen. The building in the rear is the original lifesaving station dating back to 1874. On command the surfmen move the beach cart to the drill site. The Keeper directs the cart to the appropriate spot. A sand anchor is buried, the shotline box is inverted, and the cartridge is loaded. The wreck pole is in the background and represents the mast of the stranded vessel.



After allowances are made for the wind, the Lyle Gun is fired by the Keeper in an attempt to get the line aboard ship. Note the airborne projectile with the attached shot line as it heads towards its target. The shot line is tied to the whip line behind the block. The Keeper makes a signal to the wreck pole to haul on board. When the tail block has been made fast on board the wreck, the hawser is hauled out, and the crotch is raise. The surfmen handle the whip line and rig the breeches buoy, which is then hauled out to the wreck pole



From the crowd a victim is selected and then rescued from the wreck pole by means of the breeches buoy. The details on the working of the breeches buoy are difficult to explain in words, but basically the lee whip is used to haul the device offshore and the weather whip is used to haul the victim ashore. After several victims are saved the cart is repacked. This is accomplished below by surfmen (left to right) Darryl Collins, Craig Sheldon, and Fent Davis as the Keeper (Steve Ryan) supervises.

Fletchers Neck LSS

Elinor De Wire
Mystic Seaport Museum

Imagine living in a house that once sheltered the shipwrecked, a house where an endless vigil was kept over the sea and the cries of the doomed passengers and crews echoed across the water. Here, surfman ate, slept, stood watches, and drilled with 1000-pound lifeboats, always ready to face the perilous waves when a call for help was heard.

Such a house does exist. It's a genuine relic from the maritime past, and for about $795,000—which is negotiable—anyone can own it. Fletchers Neck Lifesaving Station at Biddeford Pool, Maine is a piece of yesterday on the market today.

The concept of *history for sale* is an issue that we will increasingly grapple with as new technology upstages archaic methods and machinery. Lifesaving is no longer the dangerous and rigorous duty it was years ago, though today's Search and Rescue teams certainly earn their pay. A place like Fletchers Neck Lifesaving Station has outlived its usefulness in the utilitarian sense, but can we afford to let it slip into private hands and risk it being altered beyond recognition when so few original examples of this type of structure still exist?

The agency selling this property does not emphasize its real value. Instead, an advertisement for Fletchers Neck stresses the benefits of a "large lot, conversion expansion possibilities, and rocky Maine Coast," while ignoring the importance of the buildings as historic structures. The historic boathouse itself—the shining jewel among the property's old buildings— is described in this way "Does not contribute to the overall market value of the property.

The station is located on Atlantic Avenue, facing the broad sweep of open ocean where everything from peapods to hulking cargo ships passed. Today, the original stick-style lifeboat station, built in 1874, remains in good condition, along with the more recent Coast Guard lookout station, built in 1938 and abandoned in 1973. Three smaller ancillary buildings also remain standing. The entire complex is currently owned by the York County Counseling Services which has been using it for educational programs.

The spacious Coast Guard station has been modernized somewhat with the installation of carpeting, a second bathroom, updated kitchen appliances, but the 19th century lifeboat house remains virtually unchanged. The floors are still government gray with weight limits stenciled on them. The double doors and boat ramp remain intact, along with the gear lockers and the stove chimney. Surprisingly, even the old wheel ruts are still visible on the ground below the double doors where the lifeboat was once rolled out for drills and emergencies.

Wick York, an architectural consultant and authority on lifesaving stations, says that Fletchers Neck was one of the first five lifesaving stations built in Maine and New Hampshire. The Victorian designers opted for an architectural style that was both functional and beautiful.

In 1874 when the station was established, the native population was small. Few homes stood on the windy, storm-battered sand but among them were the small shacks, formed in a horseshoe around the old lifeboat station, where the surfmen's families lived.

Elinor De Wire

Robert Realty's Kevin Robert, who is listing the property, knows very little of its history but would like to see it serve another humane purpose in the future. Zoning will permit a variety of uses of the old station. With its proximity to the water and spacious interior, the main building seems ideal for educational programs conducted by an organization that can–if only in spirit–preserve and perpetuate Fletchers Neck's charitable lifesaving mission.

The headkeeper and six surfmen were all sturdy fishermen and boat handlers from surrounding towns who received low pay for the dangerous and desperately needed services they provided.

The lifesavers' homes are gone now, but with a little patience, evidence of the daily routine of over a century ago can be imagined–the lifeboat drills, beach patrols, the gardens and horse stable, the children playing, and the wives at work. Certainly not least among the everyday events were the many rescues performed by the station men.

In the past, the station has served as a retreat for maritime classes and seminars sponsored by the University of New England. L.L. Bean, the nationally known sporting goods store, has held its annual kayaking seminar at the station for the past few summers.

Nevertheless, the property will end up in residential use, probably as a family compound. In the year the property has been on the market, only families have asked to see it. The town of Biddesford has shown no interest in purchasing the station, though its significance as an historic building and its role in the town's history are immeasurable. Even more disheartening is a local architect's proposed plan to convert the station into seaside condominiums.

Seldom does the public have the opportunity to own an important and irreplaceable piece of history. Since the 1960s Congressional legislation has recognized and encouraged historical preservations if they meets specific criteria. Architectural style and the physical condition of a structure greatly contribute to its eligibility for inclusion on the National Register of Historic Places. Fletchers Neck Lifesaving Station has been nominated and undoubtedly will meet the requirements for admission to this respected list.

Even so, it still may be bought by private interests who could permanently alter its appearance unless the government or some civic-minded group steps forward to claim it as a vital part of the maritime past. Ultimately, preservation of a historical place hinges on who ends up owning it. It could easily become a convenience store selling beer or cigarettes or gasoline rather than a heritage park or museum that enshrines the lives of those who kept watch over the sea and saved lives.

Elinor De Wire

Wind Speed & Direction

Martin S. Baron
National Weather Service

Wind is defined as air in motion, and a description of the wind requires a specification of speed, direction, and gusts. The official unit of horizontal wind speed is the knot (one knot is one nautical mile per hour or .514 meters per second). Up to 98 knots, wind speed (ff) is coded in actual knots. For 99 knots or greater, ff in group Nddff is coded as 99, and wind is reported using the high speed wind group 00fff (code fff with the actual wind speed). Group 00fff is omitted from the weather message for wind of 98 knots or less).

There are two methods of determining wind speed from a moving ship at sea. In one method, a judgment can be made based on the state of the sea. Another method uses a masthead anemometer to take a mean reading over a 10-minute period, combining a ship's heading and speed to obtain true wind.

The first method is by far the most common and uses the Beaufort Scale. The specifications for each Beaufort number are based on wave height and length and the appearance of ripples, crests, whitecaps, spray, and foam. It is important to remember that the Beaufort descriptions for seas are for steady state conditions, which result when the wind has been blowing from the same direction for a relatively long time over a long fetch. When estimating wind speed, there are some factors to consider:

1. **There is a lag time between the increase and decrease of wind and the falling and rising of seas.**
2. **Rain will smooth or damp down wind effects on the sea surface.**
3. **Strong surface and tidal currents will have a damping effect on the sea surface.**
4. **Sea measurements are less reliable in shallow water or when taken close to shore because of tidal currents and the shelter provided by land.**

The second measure, measuring wind speed with a masthead anemometer is less frequent at sea owing to the expense and siting difficulties. Also, the ship's structure complicates the air flow making accurate readings hard to obtain. The instrument should be sited as far forward and as high as practicable. When using an anemometer, a mean reading should be taken over a 10-minute period to determine true wind by using the wind plotting board (available from any Port Meteorological Officer (PMO). Wind estimates based on the Beaufort scale are *true* and don't require correction for the ship's motion. Ashore, wind is measured by

anemometers which average values over a 1-minute period. The longer averaging period for anemometers on moving ships is an allowance made to minimize possible errors due to exposure and siting.

Wind direction (dd) is always specified as that direction from which the wind is blowing, expressed in degrees measured clockwise from true north (360°). East, south, and west are 90°, 180°, and 270°, respectively, and these are coded as 09, 18, and 27. A north wind is coded as 36 (calm air is designated as 00). Wind direction is best estimated from the appearance of the sea – the line of sea waves or ripples (the crest line) is always at a right angle to the direction of the wind. Breaking whitecaps and streaks of foam are also good wind direction indicators because they are blown in the direction of the wind. When the surface of the sea is invisible, e.g. on dark nights, *apparent wind direction* is determined by noting wind effects on yourself, on ship-born objects such as flags, or on funnel smoke. A wind plotting board is needed to obtain true wind direction

When using the wind plotting board to determine true wind direction and speed, four bits of information are necessary: 1) True ship's course, (2) ship's speed, (3) apparent wind direction, and (4) apparent wind speed. True wind speed and direction are then easily obtained by following the instructions on the board.

There is no provision in the coded portion of the weather message to report wind gusts. Gust conditions should be recorded in the remarks section of the Ship's Weather Observations Form B-81. These can be transmitted following the last group in the weather message. This is normally done only under STORM conditions (Force 10, 48 knots or higher), or when gusts are at least twice as high as your reported wind speed. Example: BBXX ABCD (STANDARD WEATHER MESSAGE) STORM GUST 70. ABCD are the ships call letters.

PMO Vacancy in NYC

The PMO position in New York City is currently open. Steps are now being taken to fill the position. We expect a new PMO to be selected by early 1993. The duties of the New York PMO are temporarily being handled by Martin Bonk, the PMO in Newark, New Jersey,

Four Reminders

1. Avoid confusing sea from swell. Confusion is most likely when the local wind direction happens to be with the incoming well. The swell will always have a longer period than the sea and will be more regular and uniform.
2. Complete the transmission of your INMARSAT weather report in 30 seconds or less. This helps reduce communications costs paid by the NWS. Always end the INMARSAT message with 5 periods to disconnect.
3. Always include the first 5 code groups in your weather message. All code figures in this section must be filled in:
BBXX D.....D YYGGi_w 99$L_aL_aL_a$ $Q_cL_oL_oL_o$
4. When reporting significant present or past weather (group 7wwW1W2), code the weather data indicator ix in group iRixhVV as 1; when there is no significant weather to report, 1x is coded as 2 and group 7wwW$_1$W$_2$ is omitted from the weather message.

Please review the past three Marine Observations Program columns in this publication or NWS Observing Handbook No. 1 for detailed discussions on these issues.

New VOS Program Brochure

A brochure describing the Voluntary Observing Ship (VOS) program and the role of the PMO has gone to the printer and should be ready by the end of November. These will be available on request from your PMO.

New Recruits: July–Sept., 1992

During the 3-month period ending September 30th, Port Meteorological Officers recruited 40 vessels as weather observers/reporters in the National Weather Service (NWS) Voluntary Observing Ship (VOS) Program.

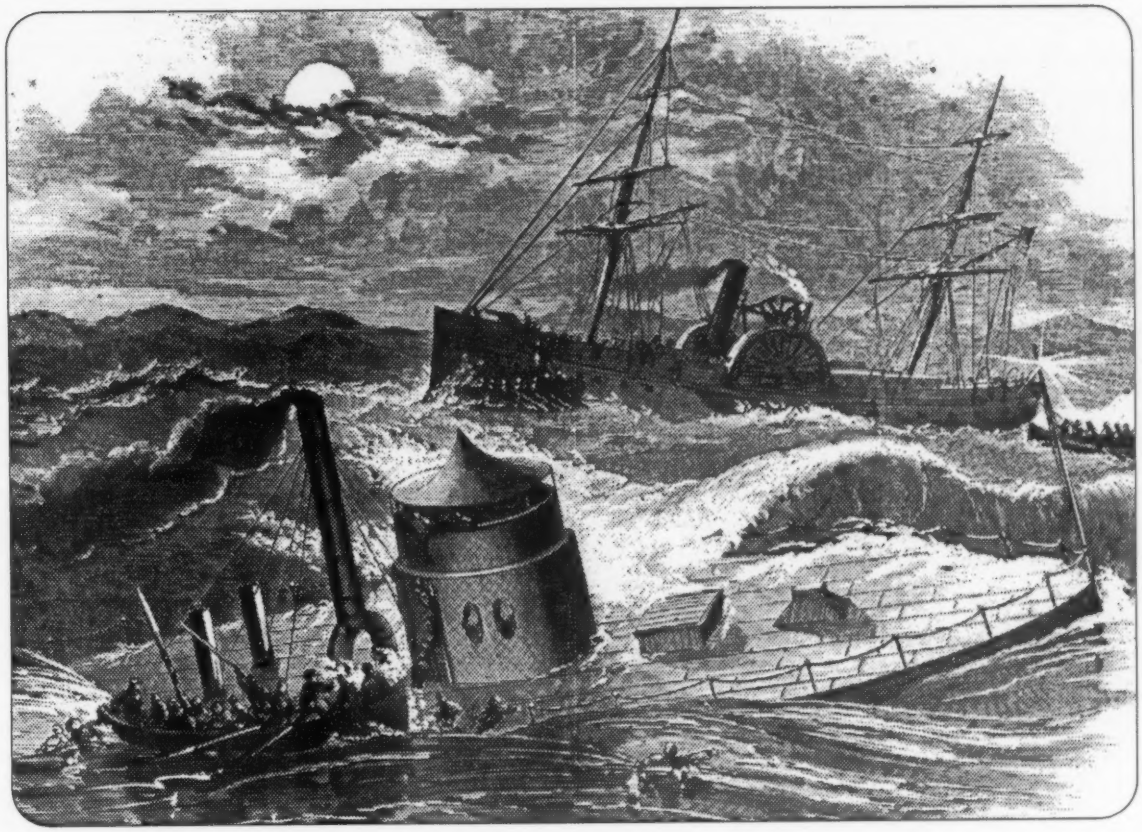
Without the support of moving ships, there would be vast marine areas without data. We thank all ships' officers who routinely take observations for their diligence and superb commitment. The value of your efforts cannot be exaggerated–your work benefits the weather forecasting and scientific community, maritime interests, and the general public.

NATIONAL WEATHER SERVICE VOLUNTARY OBSERVING SHIP PROGRAM
NEW RECRUITS FROM JULY 01 TO SEPTEMBER 20, 1992

NAME OF SHIP	CALL	AGENT NAME	RECRUITING PMO
ACTUARIA	9VJT	LYKES BROS. STEAMSHIP CO	HOUSTON, TX
ALBERTO TOPIC	ELPG7	DALMORE SHIPPING CORP	NORFOLK, VA
ALDEBARAN	ELMP5	CTGN. S.A	NEW ORLEANS, LA
ALTONIA	DIOK	LYKES BROS. STEAMSHIP CO	HOUSTON, TX
ARABELLA	S6AH	LYKES BROS. STEAMSHIP CO	HOUSTON, TX
BOB L	3EKK7	ANGLD EASTRN SHIP MGMT. LTD	NEW ORLEANS, LA
CELTIC LIGHT	ELCL6	CASCADE SHIPPING CO	SEATTLE, WA
CORPUS CHRISTI	WMRU	% AFRAM LINES (USA)	HOUSTON, TX
EVER LINKING	3ERJ2	EVERGREEN MARINE CORP	SEATTLE, WA
EXXON GALVESTON	WFQC	EXXON SHIPPING CO	LOS ANGELES, CA
FOREST KING	ELNR9	K-LINE AMERICA INC	SEATTLE, WA
FREDERICK LYKES	P3JE4	LAVINO SHIPPING AGENCY	NEWARK, NJ
GROWTH RING	3ECN7	NYK LINE NORTH AMERICA INC	SEATTLE, WA
HOEGH DRAKE	ZHEN7	HOEGH LINES AGENCIES INC	NORFOLK, VA
HUAL TRAPPER	ELJT5	AUTOLINERS EUROPE B. V.	JACKSONVILLE, FL
HYUNDAI BARON	D8EU	HYUNDAI MERCHANT MARINE INC	LOS ANGELES, CA
KAKUSHIMA	ELHX2	GENERAL STEAMSHIP CORP	SEATTLE, WA
KEYSTONE STATE	WCJI	INT'L MARINE CARRIERS	NEWARK, NJ
LIGHTSHIP NANTUCKET	WAO6139	LIGHTSHIP NANTUCKET	NEWARK, NJ
LION OF CALIFORNIA	KFBL	W HEMIS./TOSCO REFINING CO	SAN FRANCISCO, CA
LUNA MAERSK	OWDX2	MAERSK LINE	SEATTLE, WA
MANILA SUNRISE	DVIA	SHINWA MARINE CORP	NEW ORLEANS, LA
NATAL	ELGA7	GULF & ATLAN. MARITIME SER. INC	BALTIMORE, MD
NESLIHAN	TCTC	OVERSEAS SHIPPING INC	NEWARK, NJ
NOAA SHIP ADVENTUROUS	WTEE	NOAA, ATLANTIC MARINE CTR	NORFOLK, VA
NOMADIC PRINCESS	LALA4	NOMADIC SHIPPING A/S	JACKSONVILLE, FL
NORGAS VICTORY	LACN4	SHIPS NORWAY AS	HOUSTON, TX
PRODUCT SPLENDOR	VRKE	GENERAL STEAMSHIP CORP	NEWARK, NJ
R. J. PFEIFFER	WRJP	MATSON NAVIGATION CO	LOS ANGELES, CA
RIVERHEAD SPIRIT	WRGL	W. HEMIS/TOSCO REFINING CO	SAN FRANCISCO, CA
SALUD ACE	DUNN	KERR STEAMSHIP COMPANY, INC	LOS ANGELES, CA
SAN MARCOS	ELND4	CARDIFF SHIP MGMT & SER LTD	JACKSONVILLE, FL
SIMOON	HO4354	INT'L TRANS.CON. HOLLAN BV	NORFOLK, VA
USCGC CUTTYHUNK	NEDI	COMMANDING OFFICIER	SEATTLE, WA
USCGC POINT BENNETT	NAVH	OFFICER IN CHARGE	SEATTLE, WA
USNS ABLE	NABL	IUSS OPERS SUPPORT CTR	NORFOLK, VA
VIRGINIA	3EBW4	GENERAL STEAMSHIP CORP LTD	SEATTLE, WA
VIRGINIA RAINBOW	3EVT4	INTERNATIONAL SHIPPING CO	SEATTLE, WA
ZAGREB EXPRESS	9HPL3	CROSSOCEAN SHIPPING CO INC	NORFOLK, VA

Monitor
National Marine Sanctuary

Justin Kenney



Some 15 miles off Cape Hatteras and 220 feet below the ocean surface lies the nation's first Marine Sanctuary–a fitting tribute to the encrusted remains of the Civil War era ironclad ***USS Monitor.*** After several successful naval actions in Virginia waters, including its famous encounter with the ***Merrimack,*** the ***Monitor*** lost a battle to an 1862 New Year's Eve storm that raged along the Outer Banks. The gallant *Cheesebox on a Raft* which helped revolutionize naval warfare slipped beneath the surface to take its place in history among a host of less famous hulks in the legendary *Graveyard of the Atlantic.*

Mariners Weather Log

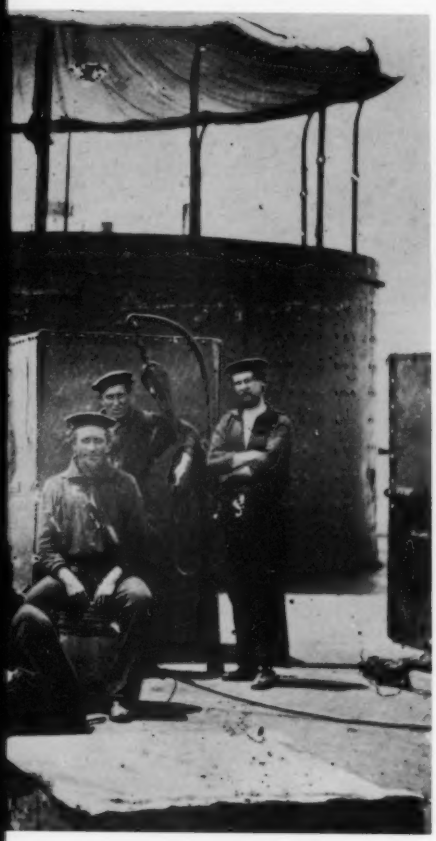
***Monitor** is the first in a series of articles on U. S. marine sanctuaries. Each sanctuary has a legacy and a story to be told, perhaps none so rich as that of the **Monitor**.*

*Special thanks to Dina Hill, Bruce Terrell, and John Broadwater for their assistance with this article. For additional information on the **Monitor** National Marine Sanctuary, please write to P.O. Box 147, Rescue, Virginia, 23424.*

An area off North Carolina was designated the ***Monitor*** Marine Sanctuary 3 years after Congress passed the Marine Protection, Research, and Sanctuaries Act. This Act responded to a growing awareness of the environmental and cultural value of the nation's coastal waters. It would create programs to protect this offshore world of coral reefs and forests of giant kelp, marine animals and sea birds, prehistoric artifacts and historic shipwrecks, the ***Monitor*** only one among many.

In January 1862, President Lincoln called the newly commissioned ***USS Monitor*** into service to assist Union forces stationed at Hampton Roads, Virginia. General McClellan's proposed strategy was to capture the Confederate capital in Richmond. This plan could only succeed if Union forces could regain control of the waters at the base of the James River. The ***Monitor,*** the prototype for ironclad warships that would forever change naval architecture and warfare, was to make this plan possible.

The ship combined existing ironclad features with new construction methods. Designed by Swedish–American engineer, Captain John Ericsson,



The engraving on page 1a from a January 24, 1863 issue of Harper's Weekly dramatizes the last moments of the Monitor. While a New Year's Eve storm rages off Cape Hatteras, the Monitor's crew desperately waits for rescue by the side wheeler Rhode Island. Of the 57-member crew, 16 were lost to the waves.
"Here we lie day after day & week after week, prisoners to all purposes, no going ashore– no nothing, but eat, drink, & sleep, & while away the tedious hours as best we may." So wrote Acting Paymaster William Keeler of the blockade duty for which the Monitor (left) had been constructed.

the ship introduced a turret with twin revolving guns that would allow firing from all sides. The formidable ***Monitor*** signaled an end to the military dominance of wooden sail-powered ships.

Confederate forces heard rumors about the ***Monitor*** and aware of the importance of defending the James River, hastily constructed their own ironclad, the CSS ***Virginia*** (rebuilt from the USS ***Merrimack***). The ***Virginia***, engineers still tightening the bolts, left Norfolk to engage Union ships at Hampton Roads before the anticipated arrival of the ***Monitor***.

On March 8, 1862, the first day of the 2-day "Battle of Hampton Roads," saw the ***Virginia*** easily defeat the Union's best ships, the ***Cumberland*** and the ***Congress***. By dark the USS ***Minnesota*** was stranded helplessly on the middle ground of Hampton Roads, and the ***Virginia*** turned toward Norfolk for minor repairs. *Virginia's* easy victory left those in Washington fearing that it could attack the Capital by way of the Potomac. A showdown with the ***Monitor*** could not come soon enough for the North. On the next morning, the two ships met in the first ever battle of ironclads.

The ***Virginia***, expecting to engage the ***Minnesota*** upon its return from Norfolk, awoke instead to a waiting ***Monitor*** which had arrived from New York during the night. For several hours the two ironclads exchanged gunfire at close range and each parried unsuccessful attempts to ram the other. The *Monitor's* twin turret guns fared well against the *Virginia's* 10 guns although neither ship was able to inflict serious damage on the other.

Even though both sides claimed victory, the battle was more likely a draw. Whether the ***Monitor*** was *the ship that saved the Union* is for historians to decide. However, it can be agreed that the battle checked *Virginia's* threat to Washington and greatly improved the morale of Union forces. It also secured the ironclad ***Monitor*** as the design of choice for the United States and Europe both during and after the Civil War.

The ***Monitor*** returned north to public acclaim. "Bully for the Monitor!" cheered a *Washington Star* headline as the ship made a triumphant return to Washington. Enormous crowds lined the Potomac River as the vessel was towed into the Washington Navy Yard for an overhaul. The crew received President Lincoln in a formal ceremony when he visited the ship. On November 6th, the ironclad was opened to the public and people queued in long lines to climb on board. The crew was especially appreciative of visitors. The assistant paymaster describes it in this way:

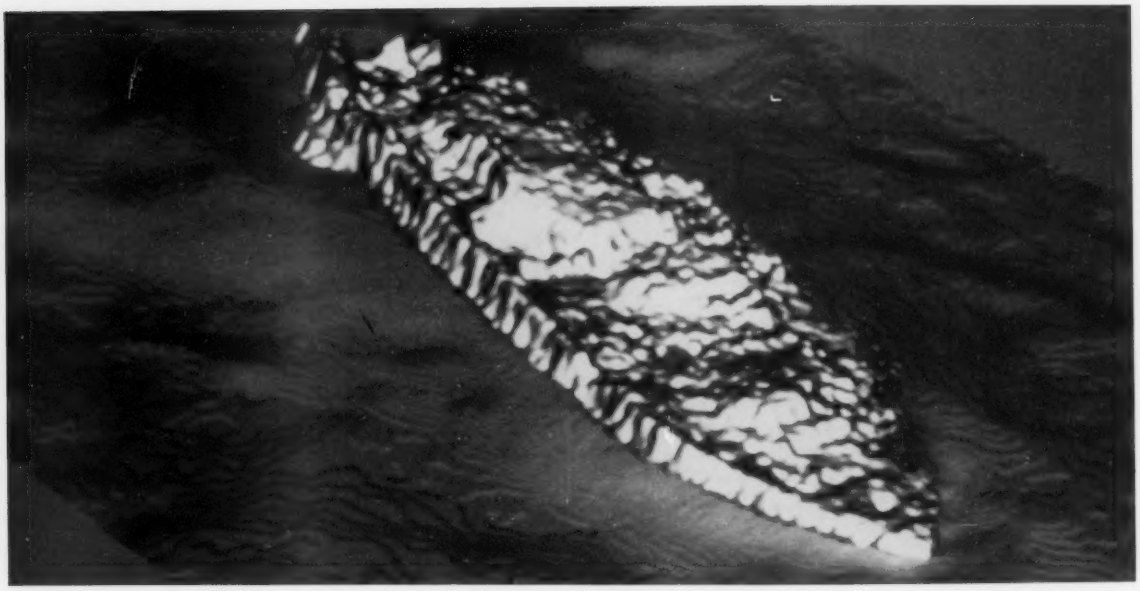
"Our decks were covered and our ward room filled with ladies & on going into my state room I found a party of the 'dear delightful creatures' making their toilet before my glass, using my combs & brushes....There appeared to be a general turnout of the sex in the city...an extensive display of lower extremities was made going up & down our steep ladders."

Within two short weeks, the vessel was ordered back to the war. On Christmas Day, 1862, the ***Monitor***, towed by the paddle-wheel steamer ***Rhode Island***, moved to join the newly-commissioned ***Passaic*** in a siege on the Confederate stronghold Charleston, South Carolina.

The first day back at sea the weather was moderate and the seas calm. As the ***Monitor*** moved farther south, and closer to Cape Hatteras, the winds and waves grew more violent.

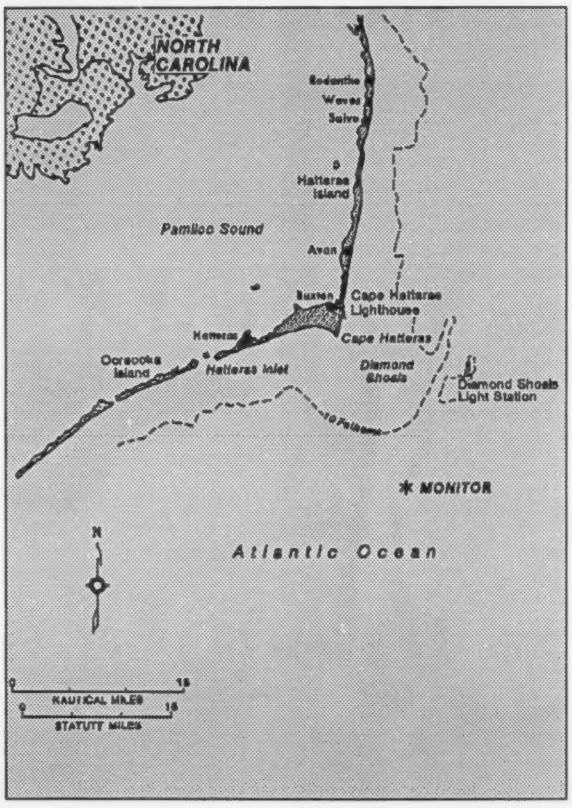
Crew members brave enough to come above deck had to cling to the top of the turret to avoid being washed off the decks covered by the wild waves. To the crew's dismay, they discovered that the ship's pumps were unable to keep up with the vast amount of water leaking around the turret. The designer Ericsson would later blame this problem on the misguided

The Monitor —

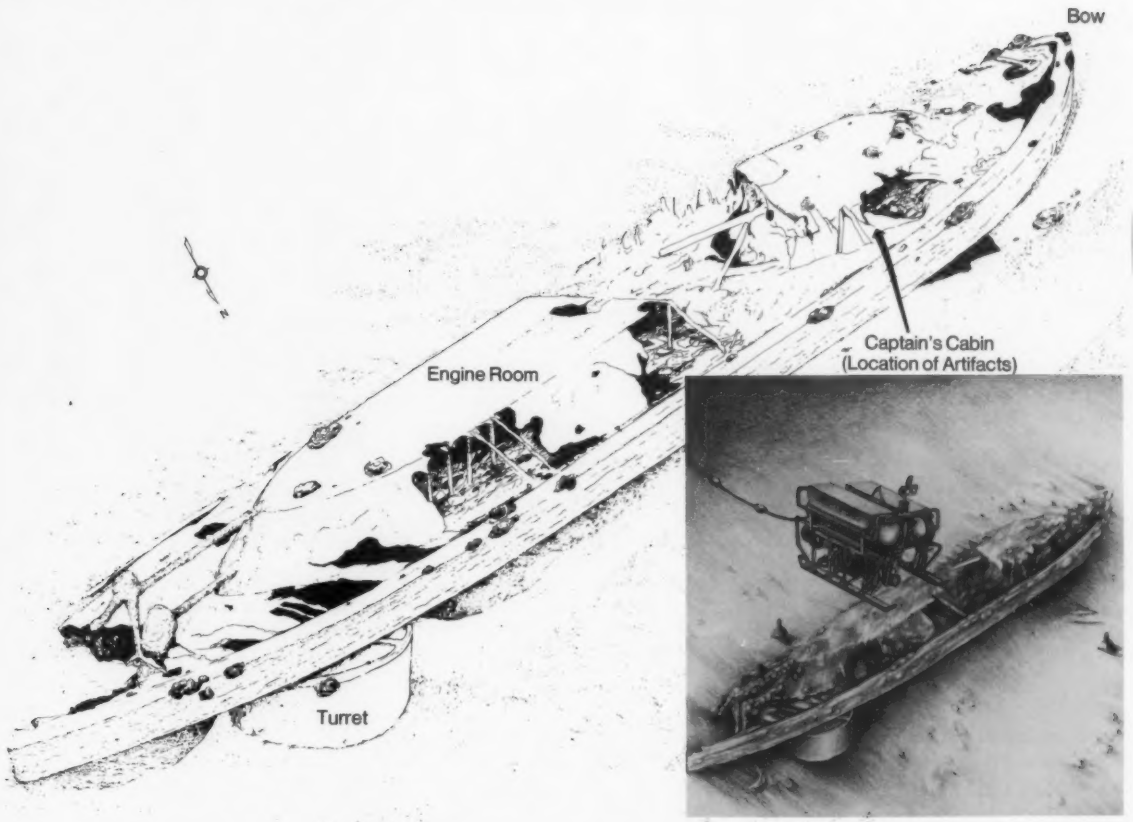


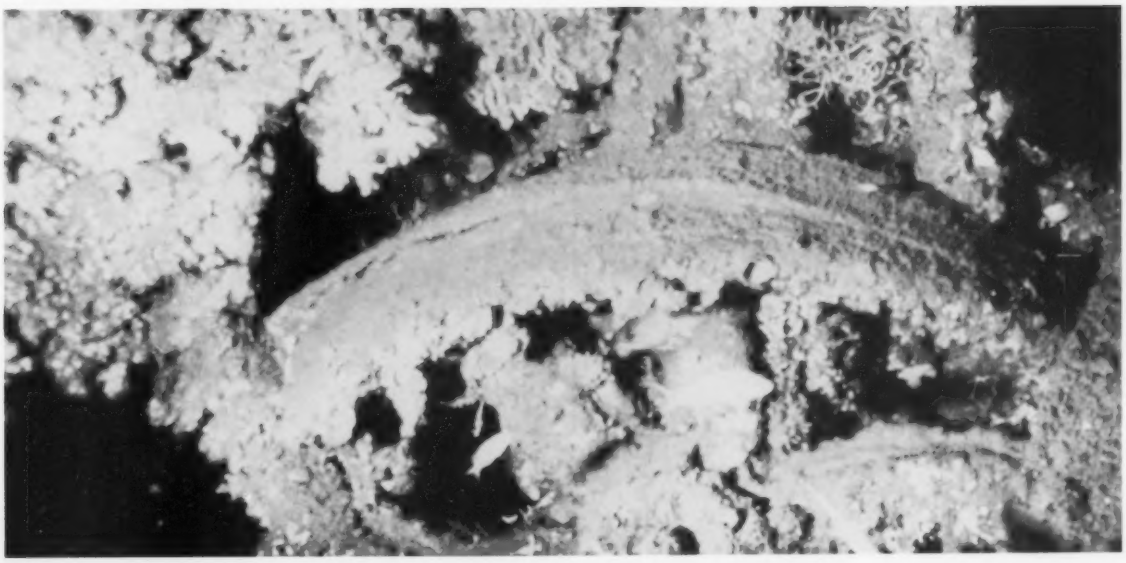
The ***Monitor*** was lost but not forgotten. For decades there were fruitless searches, efforts which intensified with the development of modern oceanographic equipment. The NOAA sketch (far right) is the result of hundreds of underwater photos 15 miles offshore and in 220 feet of water, where the ***Monitor*** was first discovered in 1973 (right) by a joint expedition team from Duke University, the State of North Carolina, and MIT. The successful search took place aboard Duke University's 117-foot research vessel ***Eastward***. Months of careful research had narrowed the *Monitor's* likely location to a 5- by 14-mile rectangle approximately 15 miles southeast of Cape Hatteras. The search picked up 22 targets most of which were ruled out by size and shape. The vessel was finally located with the aid of a "fish-finder" sonar.

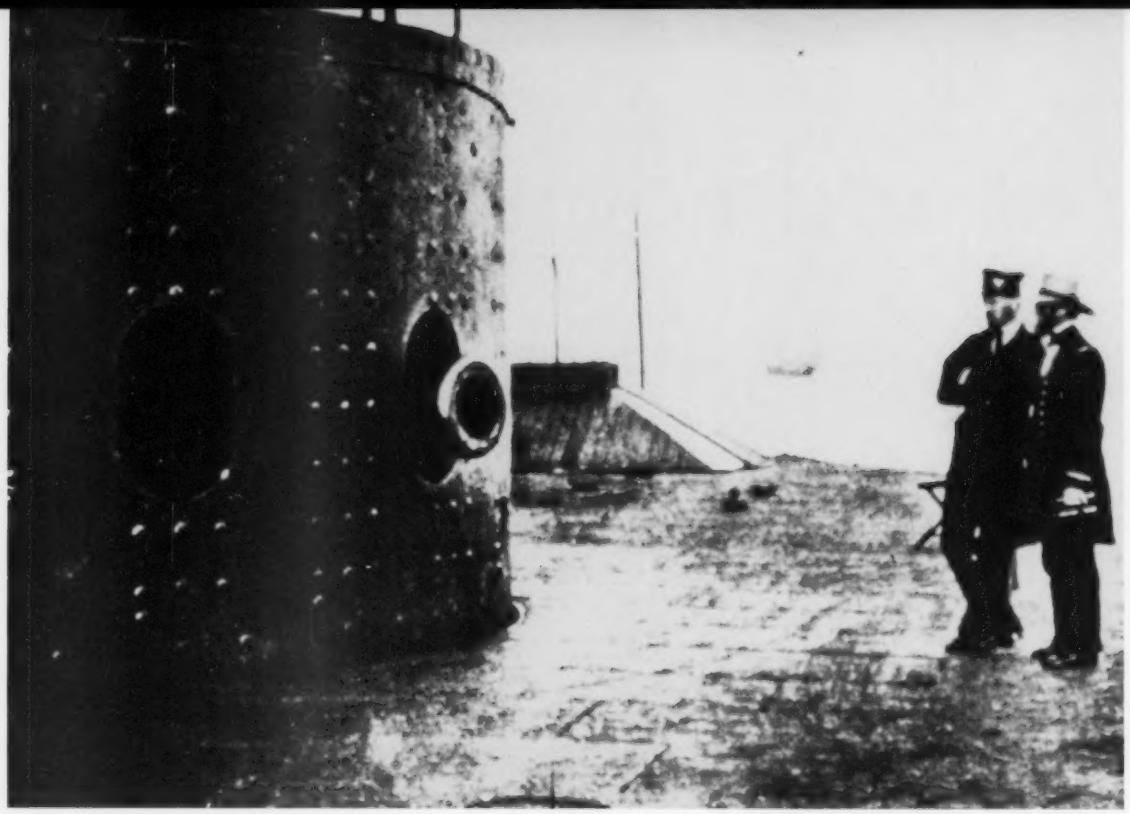
Further investigations brought NOAA involvement. Above, three-dimensional sonar generated data taken during a 1987 expedition was used to generate a model of the Monitor. This work was done by Dr. Kenneth Stewart of Woods Hole Oceanographic Institute. In the artist's representation, the U.S. Navy's remote operated submersible, *Deep Drone,* drifts above the wreck of the Monitor. Resting on its turret, the gaping hole in the corroded hulk of the armored vessel is visible. The encrusted flywheel of the Donkey engine is visible in the photograph to the lower far right.



Lost and Found







During battle, temperatures reached 140°F in the turret although designer John Ericsson had provided for a system for forced-air ventilation. While the ***Monitor*** *offered little target area for the enemy, dents and scars on the turret (above) indicate the vessel was hit on occasion. Another feature was a hidden anchor well on the centerline under the bow, where no enemy shot could reach crewmen operating the hook or chain. The encrusted anchor was recovered in 1983 and now serves as a symbol (right) for the Monitor Sanctuary.*

use of oakum as a sealant while the ***Monitor*** was in dry dock in Washington.

The sinking of the ironclad began in earnest. Seaman Francis Butts, who had unfortunately only just enlisted when the ship was in Washington, gives this description:

"The vessel was making very heavy weather, riding one wave, plunging through the next as if shooting straight for the bottom of the ocean, splashing down on another with such force that the hull would tremble with a shock that would sometimes almost take us off our feet, while a fourth would leap upon us and break far above the turret."

The high seas added to the dangerous rescue attempts. Crewman Butts described the terror of moving from one boat to the other. At one point, he described how he and and another sailor dangled from ropes over the bow of the ***Rhode Island***:

"Our hands grew painful and all the time weaker, until I saw his strength give way. He slipped a foot, caught again, and with his last prayer, 'O God,' I saw him fall and sink, to rise no more. The ship rolled, and rose upon the sea, sometimes with her keel out of the water, so that I was hanging thirty feet above the sea..."

The first lifeboat to reach the ***Monitor*** was nearly crushed against the side of the vessel. Two other rescue attempts were made, but still some men remained on board. The ***Monitor*** sank below the waters at approximately 1:00 a.m. on December 31, 1862. Of the crew of 57, 4 officers and 12 crewman were lost.

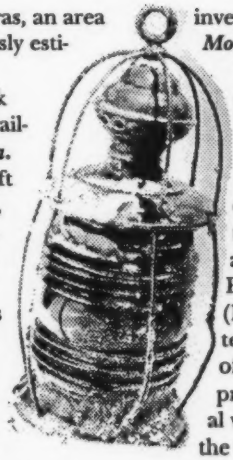
The *Monitor's* success in battle and its early demise is the stuff of legend and for a long time this legend hindered the discovery of the shipwreck. Accounts of Union sailors washing ashore and the location of grave sites led research teams to believe that the wreck must rest in waters north of the Cape Hatteras lighthouse. Several attempts to locate the ***Monitor*** revealed nothing.

However, in 1973 a team headed by archaeologist Gordon Watts (North Carolina Division of Archives and History), geologists John Newton (Duke University) and Robert Sheridan (University of Delaware), and engineer Harold Edgerton (MIT) concluded that the ***Monitor*** lay in a 5- by 14-mile rectan-

gle 15 miles south southeast of Cape Hatteras, an area considerably further off shore than previously estimated.

The team combed through the deck logs of the ***Monitor*** and ***Rhode Island,*** the trailing ***Passaic,*** and its tow ship ***State of Georgia.*** The logs were used to plot the *Monitor's* drift course based on records of speed, bearings, and positioning. They also provided essential environmental data such as wind direction and barometric pressure.

The data from the logs, depositions from survivors, and other historical correspondence from crew members was combined with modern bathymetric data and information on the influence of the Gulf Stream to estimate the most probable location of the ***Monitor.***



Once the team knew where to look, they had to find out what they should be looking for. Since the ***Monitor*** was hastily constructed using several contractors, construction details were either not complete or else were subject to contradiction. The team concentrated on what it knew—the existence of the turret, the armor belt, and hull configuration—to estimate the *Monitor's* size and shape.

Using remote sensing, the team analyzed digital readouts for data meeting the characteristics expected of the ***Monitor.*** From the 22 wrecks they discovered, only two met the criteria, and were further investigated. The second was the remains of the ***Monitor.***

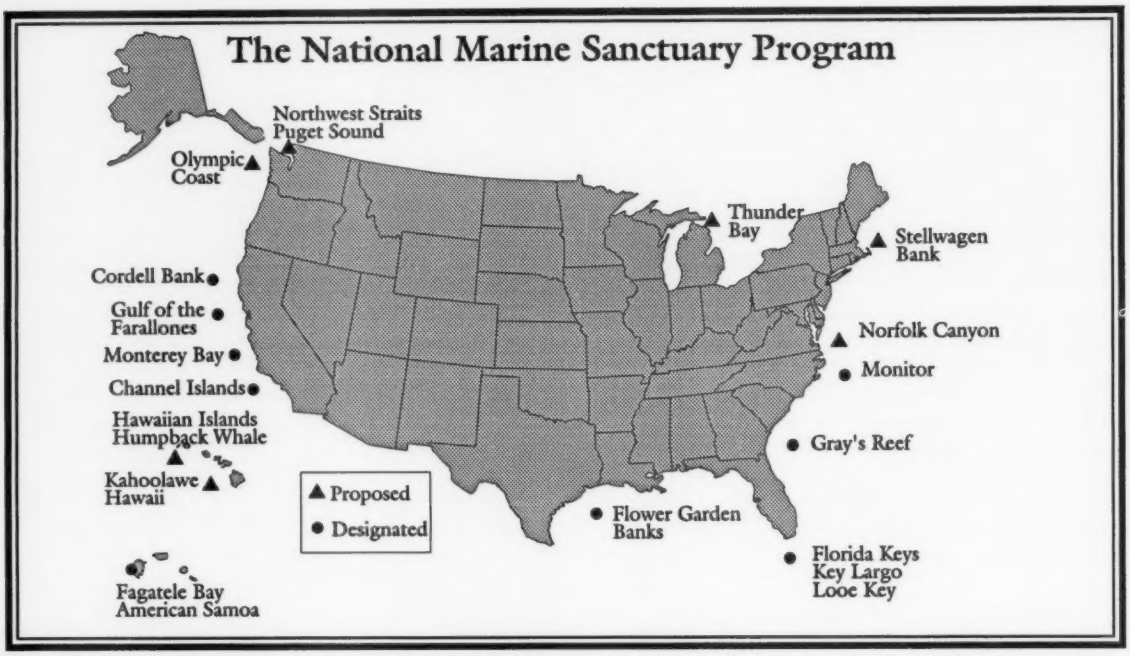
The discovery of the ***Monitor*** 15 miles offshore meant that it was outside of the state 3-mile jurisdiction and the then 12-mile federal jurisdiction. The dilemma was how to protect the wreck from unauthorized salvage efforts or possible anchor damage. The solution was the fledgling National Marine Sanctuary Program. The drafters of the Marine Protection Research and Sanctuaries Act (MPRSA) realized that a system of marine protected areas could not work within the confines of federal and state waters. The legislation must provide for sanctuary boundaries beyond federal waters, with regulatory enforcement coming in the form of federal laws and international agreements.

James Holshouser, then Governor of North Carolina, nominated the ***Monitor*** in 1974, and by 1975 the ***Monitor*** National Marine Sanctuary was officially designated. In 1977 researchers using the submersible ***Johnson-Sea Link*** ventured out for the first survey expedition of the ***Monitor.*** After settling on the bottom, the submersible slowly made its way towards the site. Historical accounts describe the red light of the navigation lantern as the last visible sign of the sinking ***Monitor.*** Remarkably, 115 years later, the first evidence of the ship seen by the researchers was its lantern, gently rolling across the ocean floor.

In the nearly 20 years since its discovery, research teams have closely studied the natural deterioration of the ***Monitor.*** However, the question of whether the ship can be raised remains unanswered. The ***Monitor*** rests in 220 feet of water, upside down on the displaced turret. The resulting stresses placed on the frame has led to structural damage and deterioration. Researchers argue whether the remains would survive an attempt to raise the ship, and if the expected conservation costs warrant such an undertaking. Even the most carefully conducted diving activities can have a detrimental effect.

Through an agreement with the Mariner's Museum (Newport News, VA), ***Monitor*** artifacts and papers (the ***Monitor*** Collection) will soon be made available for public display, both in Newport News and as traveling exhibits.

Today, 130 years after its historic engagement, the ***Monitor*** continues to serve as an example of the ingenuity of the development of a nation, its military, and its people.



Our nation's marine waters support an incredible diversity of life—the lush kelp forests off the coast of California, the limestone outcroppings of Georgia's Gray's Reef, the tropical coral reef within an ancient submerged volcano of American Samoa, and the colorful coral reefs of the Florida Keys. The mystery and beauty of these delicate ecosystems inspire scientist and poet alike to understand and appreciate their marine treasures. These waters also hold the secrets of our nation's past. Sunken civilizations, naval and commercial vessels, and countless artifacts lie silently waiting for their stories to be told.

In recognition of the special ecological, historical, recreational, and aesthetic values of our marine waters, the National Marine Sanctuary Program was established in 1972 to provide long–term protection and management. Under the direction of the National Oceanic and Atmospheric Administration, 13 marine sanctuaries have been designated, each unique in the natural and cultural resources it contains. Part of the collective riches of our nation, the sanctuaries belong to all of us to enjoy, to learn from, and most important to protect for future generations.

Channel Islands NMS
113 Harbor Way
Santa Barbara, CA 93109
(805) 966-7107

Cordell Bank NMS
Fort Mason
Building #201
San Francisco, CA 94123
(415) 556-3509

Fagatele Bay NMS
P.O. Box 4318
Pago Pago, AS 96799
(684)633-5155

Florida Keys NMS
P.O. Box 1083
Key Largo, FL 33037
(305) 451-1644

Flower Garden Banks NMS
1716 Briarcrest Drive
Suite 702
Bryant, TX 77802
(409) 847-9296

Gray's Reef NMS
P.O. Box 13687
Savannah, GA 31416
(912) 356-2496

Gulf of the Farallones NMS
Fort Mason
Building #201
San Francisco, CA 94123
(415) 556-3509

Key Largo NMS
P.O. Box 1083
Key Largo, FL 33037
(305) 451-1644

Looe Key NMS
Route 1, Box 782
Big Pine Key, FL 33043
(305) 872-4039

Monitor NMS
NOAA
Building 1519
Fort Eustis, VA 23604
(804) 878-3511

Monterey Bay NMS
Hawaiian Islands Humpback Whale
Stellwagen Bank
1825 Connecticut Ave. NW
Suite 714
Washington, D.C. 20235
(202) 606-4126

Kamloops

Skip Gillham

For fifty years the fate of the Canadian vessel ***Kamloops*** remained a mystery. Many speculated that while struggling through a winter storm, it collided with the jagged rocks of Isle Royale. But, on August 26, 1977, divers located the missing hull on the opposite side of the island, and in the engine room found its last telegraph which read, "Finished with Engines." This discovery made possible a more accurate account of the vessel's final voyage.

The package freight carrier was typical of the many Canadian ships built for trading through the Third Welland Canal and the locks and channels of the St. Lawrence River in the pre-Seaway era. Built in 1924, its size—260 feet in length, 42.9 feet at the beam--ensured it safe passage through the locks.

The final voyage of the ***Kamloops*** began in the lower Great Lakes in early December 1927. Bound for the Canadian lakehead ports of Fort William and Port Arthur, it stopped first for additional cargo at Sarnia, Ontario at the southern end of Lake Huron. The weather had been rough on the upper Great Lakes, and after moving through the Soo Locks on the St. Mary's River, Captain Brian elected to ride it out at anchor in Whitefish Bay on Lake Superior.

When the worst seemed to be over, the ship set sail across Lake Superior trailing two other ships, the ***Quedoc*** and the ***Winnipeg***. These vessels would reach the safety of the lakehead and report hurricane force winds and blinding snow during their passage. ***Kamloops*** not far behind, would disappear on Dec. 6, 1927, taking with it the entire crew of 33 sailors.

Five decades later divers spotted the hull 300 feet off Isle Royale. The bow was at 250 feet with the stern at 175 feet. The heavy ice which covered the ***Kamloops*** is now given as the cause of the disaster. As the ship fought the fierce storm, it turned to avoid a collision with Isle Royale in its final approach to the lakehead. Soon the top-heavy stack toppled off and steam lines were broken. The ship, now listing and powerless, went down off Twelve O'Clock Point. It is believed that the crew did abandon ship, but they never had a chance in the wild and freezing waters.

The Kamloops was built by the Furness Shipbuilding Company and launched at Haverton Hill-on-Trees, England in 1924. On its final voyage, it carried machinery for a new paper mill, imported teas and candies, toothpaste, shoes, rolled fence wire, tar paper, water pipes and some new life preservers. The photo is from the Earl Simzer Collection, courtesy of George Ayoub.

Cyclones of the Southeast Pacific Ocean, 1990–1991

Fiji Meteorological Service

The staff of the Fiji Meteorological Service who contributed to these reports include Rajendra Prasad, Graham Ward, and Sudha Pandaram. These summaries are considered preliminary. The track of Tropical Cyclone Peni has been amended since it first appeared in the fall 1990 issue of the ***Mariners Weather Log.***

Just a reminder that in the South Pacific Ocean the term tropical cyclone refers to a storm with winds of 34 knots or more, while the term hurricane is used when winds reach 64 knots.

–editor

Tropical Cyclone Sina November 24–30, 1990

Sina launched the 1990/91 cyclone season with a destructive 7-day storm that affected four countries and caused $18.5 million dollars of damage. While relatively small, Sina was an intense tropical cyclone with tight circulation.

Sina evolved from a tropical depression about 230 miles northwest of Rotuma on the 24th. Initially following an erratic course, it underwent a small clockwise loop before it began a southerly track.

Sina reached peak intensity around 1800 UTC on the 26th about 18 hours after it had developed hurricane force winds around its center. Maximum average winds were estimated at 75 knots with momentary gusts up to 110 knots.

On the 27th Fiji received most of the cyclone's strength as it cut across the southern and southwestern parts of the country. Storm to hurricane force winds averaging speeds up to 65 knots and momentary gusts to 95 knots battered the island for several hours. The cyclone moved steadily east-southeastward destroying buildings, knocking down power lines, and uprooting trees. Nearly 80% of the $18.5 million dollar damage was losses to the sugarcane and pine plantations.

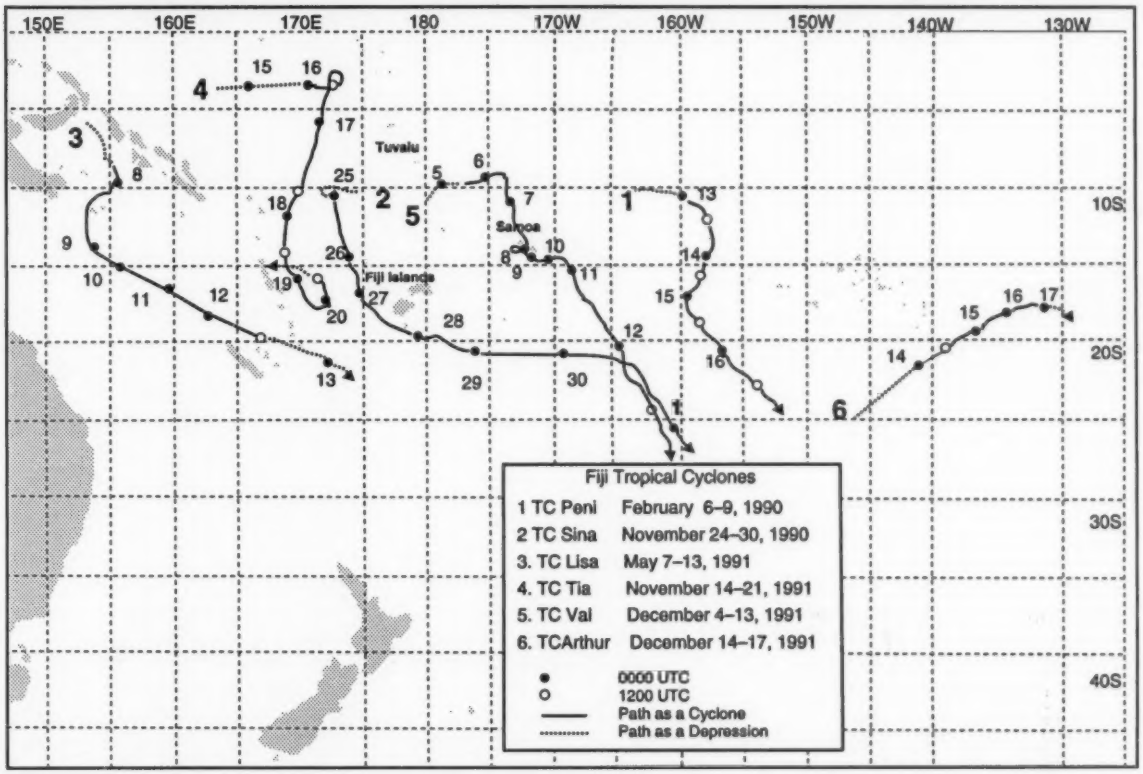
The Regional Tropical Cyclone Warning Center (TCWC) at Nadi provided Special Weather Bulletins on the cyclone position, movement, intensity, wind distribution, and organizational characteristics that helped avert loss of life and livestock. TCWC issued its first warning on the 24th and continued advisories every 12 hours for the duration of the storm while its radar tracked Sina's path.

Tropical Cyclone Tia November 14–21, 1991

Tracking Tropical Cyclone Tia was made more difficult by abrupt changes in direction during its lifespan. Tia developed from a small depression that originated in the Solomon Islands east of Malaita Island on November 14th and while most of its energy was expended over the open ocean, when it hit land, it hit hard.

Before it weakened, 90% of all dwellings on the island of Tikopia had been completely destroyed and the remaining 10% had collapsed walls or roofs blown off.

The cyclone first moved



eastward at about 05 knots and then southwestward as it intensified rapidly, reaching storm strength about 0000 UTC on the 17th and hurricane intensity about 1500 UTC on the same day. At that time maximum average winds were estimated at 55 knots and expected to reach 65 knots within the next 12 hours. The presence of hurricane force winds was confirmed when the automatic weather station on Anuta Island, in the Solomons, reported winds averaging 65–70 knots between 1500 and 2000 UTC on the 17th.

Much of the severe damage was sustained on Tikopia while the other islands in the area (Ambae, Epi and Tongoa) received minimal damage to crops and older houses.

By November 19th the cyclone was downgraded to storm status, later that day to gale, and finally to tropical depression on the 20th.

Tropical Cyclone Lisa May 7–13, 1991

Tropical Cyclone Lisa, the first cyclone to develop outside the normal season since 1986, kept a steady rate of movement during a large part of its lifespan. Apart from coming close to Aneityum in southern Vanuatu, it spent most of its life over the open sea and so caused little damage to nearby islands. It followed a steady rate of movement and only temporarily slowed down when recurving.

On the 7th of May, Lisa originated from a weak depression along the Convergence Zone near Bouganville in the Solomons. With gales around it, Lisa moved initially toward the south-southwest at a little less than 10 knots. By 1800 UTC on the 8th, the system had turned southward, steadily intensifying as it moved. Steered by upper-level northwesterlies, the system curved gradually toward the southeast, reaching storm intensity by the 9th. It started out moving in a south-southwesterly direction, before it curved southeastward to cross 160°E and enter into Fiji's waters.

Developing as it did outside the normal cyclone season, Lisa was a moderately intense system cyclone by comparison. Its intensification was gradual, but the system weakened very rapidly and at much lower latitude than is usual.

Tropical Cyclone Val
December 4–13, 1991

$700 million dollars worth of damage was left in the wake of Tropical Cyclone Val, which will go on record as a major cyclone of this decade. The movement of the cyclone helped to increase the damage. Val attained peak intensity just before approaching land. It passed directly over Western and American Samoa, and its slow movement only prolonged the effect of its destructive winds.

Val developed as a tropical depression, initially gales in its northern semicircle, just to the southeast of Tuvalu on December 4th and moved northeastward for nearly 2 days. On the 5th with tropical cyclone characteristics gales developed all around its center and steered by upper north to northwest winds, Val began curving towards the south, then southeast, and headed straight for Samoa.

It attained hurricane force winds close to its center as it approached Savaii where it reached peak intensity with maximum average winds estimated at 90 knots and gusts to 130 knots.

Soon after Val made a sharp clockwise loop, which brought it almost over Savaii a second time, completing the loop by 1800 UTC on the 8th. Afterwards, 95% of Savaii's houses were either destroyed or badly damaged.

The cyclone caused severe damage to the Samoas. Fifteen people were killed in Western Samoa and estimated damage was nearly $200 million dollars. In American Samoa, one person died and crop destruction was valued in excess of $50 million dollars.

Tropical Cyclone Arthur
December 14–17, 1991

Tropical cyclone Arthur formed out of a tropical depression east of 140°W in an area of the South Pacific that last experienced a similar storm in the 1982/83 season. Arthur was the residue of Tropical Cyclone Wasa which had passed directly over Tubuai, Austral Islands on the 12th of December. Wasa, abating into a tropical depression, appears to have initially turned eastward, before turning toward the northeast. Regenerated over warmer waters, and renamed Arthur, the winds increased to a marginal storm force (1200 UTC) on the 14th and passed about 80 miles north northwest of Mururoa Atoll. The land station there reported 40-knot winds and 998.4-millibar low pressure. Also at the same time, a ship located about 30 miles to the north of the cyclone center reported the strongest wind at 48 knots and pressure of 995.0 millibars.

Arthur swept across the Actaeon Islands and several atolls before it turned east and weakened on the 16th. It finally degenerated into a shallow depression late on the 17th. Tracking Arthur throughout the Wasa/Arthur transition stage and its short lifespan of only 3 days was made more difficult because of the lack of surface reporting stations and poor satellite coverage for the area.

The Life–Saving Museum of Virginia

Dedicated to Those Who Stood Ready to Serve

The Life–Saving Museum of Virginia is the only existing station in Virginia—among a mere handful on the entire Atlantic Coast—open to the public, preserving the history of the Life–Saving/Coast Guard Service, standing proudly at the ocean's edge. It is a tribute to the memories of those men and women who endured the hardships of the sea in peace and war, and of those who stood ready to serve.

For information write:
The Life–Saving Museum of Virgina
24th Street and Atlantic Av.
Virginia Beach, VA 23451
(804) 422–1587

Interview, Awards, and News

Randy Sheppard
PMO Nova Scotia

Getting to Know Your PMO

MWL: How long have you been in the PMO program, and what was your background?

RANDY: I have been in the PMO program since November 1990. I'm from Sydney, Cape Breton, Nova Scotia. I've been with the Atmospheric Environment Service for 14 years. Prior to becoming a PMO, I worked as a weather briefer at various weather offices in the Atlantic provinces–Halifax and Yarmouth in Nova Scotia, St. John's in Newfoundland, and Goose Bay, Labrador. Before that I worked at several isolated weather stations in northwestern Ontario and the High Arctic. I also spent 2 years on Sable Island. During these postings I served as weather observer and radiosonde or upper air soundings technician .

I was on Sable Island, the *Graveyard of the Atlantic,* [Canadian version] in the winter of 1981 when the cargo vessel ***Euro Princess*** grounded on a sandbar during a storm. There was a threat to the nearby ***Rowan Juneau*** oil rig should the vessel break free, so all the crew members of the ship and rig were evacuated to the island by helicopter.

Our weather station staff normally is comprised of five technicians with their wives and children. That brings the total population of the island to ten. The addition of 60 sailors and rig workers for a period of 2–3 days made for some innovative ideas in the care and feeding of the men. Luckily, the episode ended with no loss of life. The ***Euro Princess*** was refloated and the rig workers returned to the Rowan Juneau.

MWL: Are you required to travel to Yarmouth, Shelburne, and other ports?

RANDY: The Atlantic region of Canada contains the provinces of Nova Scotia, New Brunswick, Prince Edward Island, Newfoundland and Labrador, and the Atmospheric Environment Service has two PMOs overseeing the VOS program there. Darryl Miller looks after Newfoundland and Labrador, and I'm responsible for the other three provinces. On the east coast, we currently have 95 ships recruited to the VOS program.

The smaller ports Yarmouth and Lunenburg in Nova Scotia, Shippigan and Blacks Harbour in New Brunswick, and Souris and Borden in Prince Edward

Island all require visits. I also travel to the larger ports of Saint John, New Brunswick, Charlotte, P.E.I., and Sydney in Cape Breton.

The Atmospheric Environment Service provides, installs, calibrates, and maintains the weather equipment on most of the ships we have recruited. We like to visit our ships at least twice a year to check on the weather program, resupply them with stationery, and calibrate equipment.

MWL: Don't your duties include more than regular ship recruiting and visitation activities?

RANDY: Yes, the expanding role of the Canadian PMO now includes assisting in the recovery, deployment, and maintenance of our offshore weather buoy network. On the east coast, we now operate six NOMAD weather buoys. Last year it required five trips aboard Canadian Coast Guard vessels to service them.

Special projects such as CASP II (Canadian Atlantic Storm Program II) involved deploying and recovering two weather buoys on the Grand Banks during the storm season. These trips average 5 days to a week at sea.

We also have a network of coastal stations that provide weather observations for us. These stations are operated by the Canadian Coast Guard and require visits to train staff, resupply, and install or calibrate weather equipment.

MWL: Does the Atmospheric Environment Service use fishing vessels that operate out of Nova Scotia for observations?

RANDY: At present we have two fishing vessels or auxiliary ships in Nova Scotia which take weather observations. They are both scallop draggers. The ***MV Anne S. Pierce*** operates out of Lunenberg, and the ***MV J.L Hart*** fishes in the Bay of Fundy. We are now in the process of implementing a Marine Weather Reporting (MAREOP) program for the east coast. Basically, this program consists of recruiting smaller vessels, fishing and recreational boats, to provide plain language weather reports while at sea. They pass them to Canadian Coast Guard radio stations. These reports are then forwarded to our forecast centers in Bedford, Nova Scotia and Gander, Newfoundland.

MWL: What role do superstructure icing observations play in the program?

RANDY: From about November to April, superstructure icing is a serious hazard for vessels in east coast waters. Forecasters watch for the combination of air and water temperature, wind speed, and wave heights; and if the conditions warrants, a freezing spray warning is issued. Warnings are given when moderate to heavy vessel icing is expected. The ice accretion group included in the ships' weather observations helps the forecasters determine if such a warning should be issued or continued.

MWL: Beside working for the Atmospheric Environment Service, do you have any other hobbies?

RANDY: During the winter I play tournament and league hockey, and in the summer, the golf clubs come out. I also play baseball—either catcher or shortstop for the local weather office team.

MWL: Can you tell us a little about your family?

RANDY: I've been married to my wife Karen for 12 years. We have a 6-year-old son Christopher, and a daughter Kelly, who is 4 years old.

MWL: A lot of people think of Nova Scotia as sort of a cold outpost, but from the little I've seen, it's pleasant and beautiful. It has a cosmopolitan side as well, doesn't it?

RANDY: Well, on Nova Scotia license plates is the inscription "Canada's Ocean Playground." We are almost totally surrounded by sea and that gives us miles of picturesque coastlines and secluded beaches.

The ocean moderates our winters and summers, so inland temperatures are usually a few degrees higher in the summer and lower in the winter than coastal areas. The overall effect is to give us milder winters and cooler summers than provinces to the west.

We have the best of both worlds in Nova Scotia. The cities of Halifax, Dartmouth, and Sydney combine to give us the big city advantages with museums, concerts, professional sporting events, and nightlife, while the peace and the quiet of country life can be found a mere 10 minutes away.

This side up

News From the Port Meteorological Officers

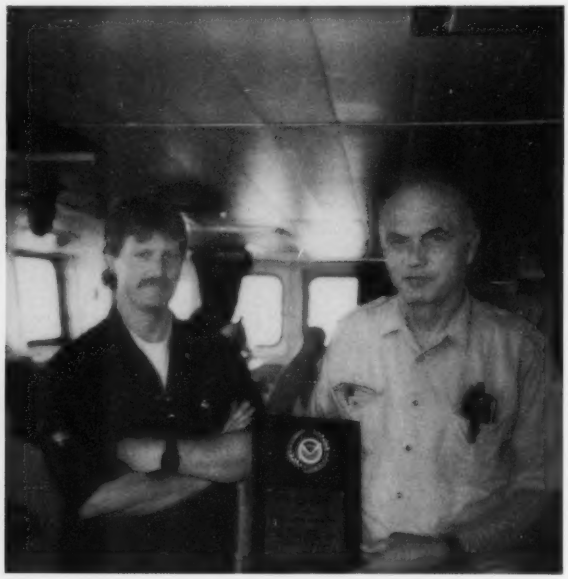
Dan Keeton, PMO, Alaska

Meteorologist Dan Keeton has signed on to head the Weather Service Office in Kodiak, Alaska. A 1987 graduate of Oregon State University, Keeton was first assigned to Barrow Observatory in Oregon. Later, he worked as marine forecaster at WSFO Anchorage and station manager in Kodiak.

Keeton's new duties will take him to two of the largest fishing ports in the country, ports he described as "large in both dollar value and pounds landed." At left, "Kodiak Keeton" stands on the USCG dock with the USCGC *Ironweed* behind.

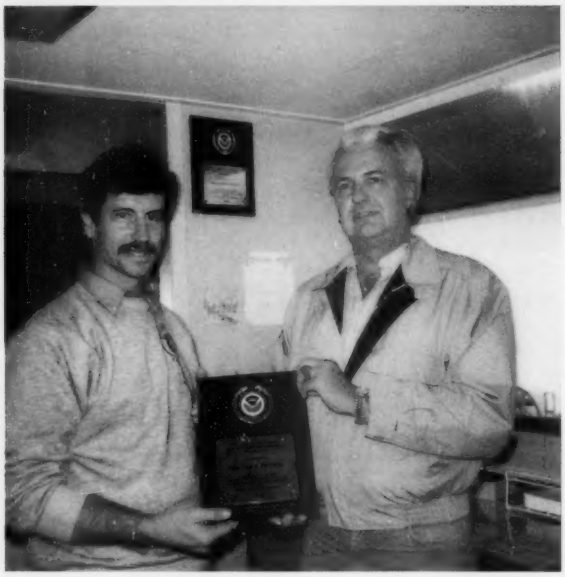
Martin Bonk, Newark PMO, (above) speaks to the meteorological cadets at Massachusetts Maritime Academy, the oldest continuing maritime school in the nation. This new program, headed by Capt. Jeffrey Monroe, allows the students to be directly responsible for marine observations going to the National Weather Service. The information they provide is considered vital because of the campus location at the west end of Cape Cod Canal, a major marine traffic area. The program is geared for expansion in the coming year.
The photo to the left comes from M.V. Chicksaw's Captain U.R Thakore, a valuable member of the VOS program. Captain Thakore kindly sent along this photo of the M.V Chicksaw battling ice enroute from Quebec.

The 1992 VOS Awards Continue



Port Meteorological Officers present VOS awards each year to selected ships for their overall performance in the weather observation program. Photo (above left) shows the crew of ***NOAA Ship Ferrell*** *receiving their award from PMO Ray Brown of Norfolk. Virginia. Left to right is CQM Ed Jaynes, Captain Andrew Armstrong III, Ordinary Seaman Tracy Rush and Ordinary Seaman Cheryl Ude. Holding his ship's award, (above right) is* ***Sea–Land Achiever*** *Ch Mate Vincent J. Thompson with 2nd Mate John A. Long. PMO Ray Brown of Norfolk presented the award. Captain Billy Molero., Jr. (bottom left) accepts recognition from PMO Jack Warrelmann for his work on the Lykes Bros Steam Ship Company. Below, right Warrelmann is flanked on both sides by the crew of the NOAA'S award winning vessel* **Oregon II.** *On the left is Executive Officer LCDR Rick Brown and on the right Second Officer James Rowe.*

VOS Awards are given annually to selected ships for their outstanding weather observations. Ray Brown, PMO Norfolk, (above left) hands out yet another award (above right) as he enters his 41st year as a PMO. With Brown is Captain Victor R. Sirker of the **Rainbow Hope.** *Meeting another milestone of sorts, the crew of the* **Edwin H. Gott** *can claim 1,000 weather observations in 1991. Pictured left to right are 2nd Mate Richard D. Robertson, Captain Albert D. Nelson, 3rd mate Daniel A. Rentschler and 1st mate Bruce E. Doyle. 1st Mate Cosmo J. Aracaro is not in the photo but deserves recognition. More award winners are featured below. On the left Capt. Mario Martinez of the Mexican Line Ship* **Merida** *receives an award for 1991 from PMO Jim Nelson. Chief Mate Laura Kovary and Capt. Eddo Feyen share an award on the* **SS Maui.**



Captains Kevin J. McHugh and David B. Partridge (above left) of the **Sealand Pacific** *accept an award for the 2nd year in a row from Bob Novak, PMO Oakland, CA (not pictured). In the photo (above right), Captain Saunders "Sandy" Jones accepts American President Lines, Ltd's award. APL ships not only have been among the top reporters, but have also provided other services to the scientific community. In the photo (bottom left)* **Edwin H. Gott** *crew 1st Mate Bruce E. Doyle and 2nd Mate Richard D. Robertson discuss weather data acquisition with National Weather Service forecasters. Flanking Doyle and Robertson are Tim Seeley on left and John Taylor on the right. In the final photo on this page, Seeley and Taylor stand with Captain Bill McDonald of the* **Michigan.**

What is a Chubasco?

Larry Peabody
National Weather Service, San Antonio

What in the world is *chubasco*, you ask? The name of the latest dance craze in Acapulco? How about the hot sauce served at that quaint Mazatlan beach front restaurant? Actually, it's neither of the above.

The Glossary of Meteorology defines a *chubasco* as the Spanish word for " a severe thunderstorm with vivid lightning and violent squalls coming from the land on the west coast of Nicaragua and Costa Rica in Central America." (American Meteorological Society, 1959). The same term is also used in Baja California and along the west coast of Mexico.

There are more familiar names for these storms. They're called typhoon in the western Pacific, *baguio* in the Philippines, and cyclone in the Indian Ocean. They're hurricanes in the Atlantic Ocean, Caribbean Sea, Gulf of Mexico and the eastern Pacific.

In the late spring and summer when the intertropical convergence zone (ITCZ) is most active, eastern Pacific tropical storms and hurricanes develop in the warm waters southwest of Mexico. Most of these storms will die at sea as they migrate over colder ocean waters. Some will move inland and dissipate over the desert or strike the lower California coast as squalls.

Destructive exceptions occur when storms curve back toward Baja and the west coast of Mexico. These storms are often accompanied by damaging wind, pounding surf, and torrential rain. The violent surf erodes unprotected beaches and coastlines, wreaks havoc on vulnerable fishing and pleasure vessels, and undermines exposed structures. The rain introduces new threats—viscous mud slides flow down nearby hills and flash floods gouge a normally dry river bed or branch (*ramal* in Spanish).

Even tropical storms or hurricanes that pass hundreds of miles south and west of Baja can have a far-reaching effect. Swells generated by these distant storms can reach heights of 20 feet or more on the Pacific side of Baja while on the opposite side, the Sea of Cortez (Gulf of California) is spared, thanks to the protection offered by the elongated land mass.

A *chubasco* then is the exception to normally tranquil Baja weather. Except for mountainous regions where rainfall is heavier, and despite the proximity of the Pacific Ocean and Sea of Cortez, Baja California is one of the most arid areas on earth. Although some northern locations may vary with seasons, monthly temperatures are among the most consistent of any place in the world.

During the summer, squalls with less than tropical storm or hurricane intensity or thunderstorms formed by the orographic lifting warm moist air over steep terrain can produce locally heavy rains. These rains cause flash flooding in *arroyos* and *barrancas*

San Diego Union

Hurricane Kathleen's raging flood waters poured through this canyon in September of 1976, wiping out a bridge on U.S. Highway 80 and undermining Interstate 8. Kathleen had formed southwest of Acapulco on the 6th of September and moved inland about 140 miles south of Ensenada, Mexico. It moved northward over the Sierra San Pedro and Juarez Mountains, entering Southern California near Calexico on the 10th. Although weakening, the system contained plenty of moisture as it moved northward through Death Valley and into western Nevada, spreading torrential rains into the northwestern United States.

that branch down from distant mountains.

A flash flood, known locally as *torrente,* is deceptive since its source can be miles away from a vulnerable community. Flash floods have been known to ravage a location with little advance warning, and when one strikes at night, it can be particularly devastating to those caught unaware.

El Nino is a more familiar name than *chubasco.* For more than a century *El Nino* (Spanish for a small boy or the Christ child) has been applied by South American fishermen to the annual Christmas-time appearance of warm water off the coast of Ecuador and northern Peru. Ordinarily the ocean surface there is kept cooler by the northward-moving Peru Current which drives surface water offshore, and allows cold water to well up from the depths. This water, rich in nutrients like phosphates and nitrates, help photosynthesizing plankton to flourish, and ultimately helps support the Peruvian anchovy industry once the largest fishery in the world.

In December a warm southward-moving current displaces the cool water and reduces the upwelling of nutrients so fishing is slightly disrupted. The warning extends no farther south than northern Peru, and it usually ends by March or April.

The Manzanillo Hurricane of October 1959 was one of the worst in Mexico's history. Winds and torrential rain generated floods and landslides wreaked havoc and resulted in nearly 1,000 deaths in Manzanillo, Minatitlan, and surrounding areas. Along the coast, five small Mexican merchant ships were sunk along with a naval vessel and the 1800–ton Sinaloa. The Mary Barbara, just outside the Manzanillo Harbor on the 27th, reported a 958–millibar pressure with winds estimated at 140 knots.

Occasionally, *El Nino* is more intense, more extensive, and more prolonged. Rather than dropping back to normal in March or April, sea-surface temperatures (SSTs) rise all along the coast of Peru and in the central and eastern equatorial Pacific, including the waters off Baja and the west coast of Mexico. The temperatures may stay high for more than a year.

Such relatively intense *El Ninos* were observed in 19272-73, 1976-77 and, most recently, 1982-83. The 1982-83 event, the most intense on record, caused SSTs off Peru to warm as much as 12 to 15° F. above normal. West Coast and Mexican waters SSTs also were much warmer than normal during this period, accounting for warm water fish species to appear earlier in the the year and range farther north along the Pacific coast.

In scientific circles, *El Nino* is now generally applied only to those intense events rather than to the normal relatively mild warming (between 2 and 4°F) of the sea surface. Investigations have determined that this anomalous warming of surface water in the equatorial Pacific occurs at irregular intervals in conjunction with the Southern Oscillation, a massive seesawing of atmospheric pressure between the southeastern and western tropical Pacific. Both phenomena have been known to oceanographers and meteorologists for decades. Since they occur in one of the world's most sparely inhabited and data-sparse regions of the globe, they were of interest to only a few scientists. The phenomena might have remained obscure had it not been discovered that they are related to weather in other regions, including the United States and Mexico.

One of similar intensity as the moderate 1986-87 *El Nino* is in progress at the time of this article. Much weaker than the 1982-83 event, this warming has already been blamed for record rainfall and historic flooding in south Texas and Southern California.

The 1991-92 *El Nino*, although not strong nor long lasting , is expected to have an effect on both fishing and weather off Baja and mainland Mexico. Migratory species, such as sailfish and blue marlin, generally prefer the warmer waters of mid and late summer. They may appear earlier and stay later due to the higher SSTs.

Throughout and shortly after an *El Nino*, the storm season in the Atlantic Ocean, Caribbean Sea and Gulf of Mexico is quieter–usually less than the average of ten named storms develop in a normal year. But that doesn't mean these destructive storms can't form and strike the U.S. mainland. Hurricane Alicia, which struck Galveston and Houston in 1983, was just such a storm.

The 1991-92 *El Nino*, however, may have an opposite effect in the eastern Pacific. An above-normal number of tropical storms or hurricanes can develop due primarily to the increase in SSTs. Only time will tell whether the warmer waters off Mexico and Central America will fuel embryonic storms into a full–fledged tropical storm or hurricane, the *chubasco* of Baja California and Mexico.

New Satellite Safety Codes

As a result of consultations between the International Maritime Organization and the International Maritime Satellite Organization, new safety related tariffs from INMARSAT-A and INMARSAT-C ship earth station users have been implemented by COMSAT and IDBAeroNautical's land earth stations. Ship-originated voice or data messages to the U.S.Coast Guard from INMARSAT-A. or INMARSAT-C terminals in the following categories will be handled at no charge.

Medical Assistance Calls

These calls involve grave and imminent danger situations, including MEDICO and MEDIVAC communications with the U.S. Coast Guard.
These calls can be identified by using Service Code 38.

Maritime Assistance Calls

These calls involve grave and imminent danger situations, including distress related rescue assistance communications with the U.S. Coast Guard. These calls are identified by using Service Code 39.
These include observed hazards to ships which to the ship's knowledge had not been included in warnings.

Navigation, Meterorlogical and Ice Hazard and Warning Reports.

Messages will normally report the following:

- -storm conditions (Beaufort force 10 or greater) which have not been forecast;
- -ice accretion conditions on superstructures;
- -reports of position and time of all ice sightings to the International Ice Patrol;
- -floating derelicts;
- -major aids to navigation irregularities;
- -other hazards to shipping such as uncharted shoals, rocks and obstructions.

These calls are limited to INMARSAT-A TELEX or INMARSAT-C and are identified by using Service Code 42.

Routing of Priority 3 Distress Alerts remain unaffected by these changes. Messages that are not in accordance with the above procedures will be billed at standard tariff charges.

MOBILE, ALABAMA, U.S.A

CALL SIGN	FREQUENCIES	TIMES	EMISSION	POWER
WLO	2573.9 kHz	CONTINUOUS	F3C	5 KW
	6852 kHz	CONTINUOUS	F3C	5 KW
	9157.5 kHz	CONTINUOUS	F3C	5 KW

TRANS TIME	CONTENT OF TRANSMISSION	RPM/OC	VALID TIME	MAP AREA
0230/1430	SURFACE ANAL. (GULF OF MEX.)	120/576	00/12	
—/1445	BROADCAST SCHEDULE	120/576		
0735/1910	SURFACE ANAL. (U.S.)	120/576	00/12	
0920/2030	SURFACE ANAL. (GULF OF MEX.)	120/576	06/18	
—/2040	OCEANOGRAPHIC PRODUCTS (1)	120/576	LATEST	
1045/2245	HIGH SEAS FORECAST	120/576		
1120/2330	18/36 HR. SURFACE PROG. (GULF OF MEX.)	120/576	18/06	

NOTES:
1. GULF OF MEXICO AND ATLANTIC SEA SURFACE TEMPERATURE ANALYSIS (MON/WED/FRI.)
2. ATLANTIC GULF STREAM FLOW ANALYSIS
3. GULF STREAM FLOW PRODUCTS MAY NOT BE AVAILABLE DURING THE SUMMER MONTHS DUE TO WEAK ISOTHERMAL CONDITIONS IN THE GULF. ADDITIONAL INFORMATION ABOUT THESE PRODUCTS CAN BE OBTAINED BY CALLING (301) 665-6640
4. THIS BROADCAST ORIGINATES FROM THE NATIONAL HURRICANE CENTER OF THE NATIONAL WEATHER SERVICE. COMMENTS AND SUGGESTIONS SHOULD BE DIRECTED TO: NATIONAL HURRICANE CENTER
ATTN: CHIEF OF TSAF
1320 SOUTH DIXIE HIGHWAY
ROOM 631
CORAL GABLES, FL. 33145

(INFORMATION DATED 09/1992)

All times unless noted are UTC (universal time) and all miles are nautical. For additional detail, tropical cyclones will be covered in the annual reports from the tropical cyclone centers around the world. The weather summaries are based upon the track charts and Northern Hemisphere Surface Charts as well as ship reports, and attempt to highlight the most significant ocean features each month. The track charts are provided by NOAA's National Meteorological Center. If an extra-tropical storm is particularly bad for shipping, we may designate it as the Monster of the Month.

–ed.

North Atlantic Weather
April, May, and June 1992

April–The North Atlantic is a climatological battleground in April with the Azores–Bermuda High battling the Icelandic Low for control. In the real world this usually means a mixture of highs and lows, which results in rough weather along the northern shipping lanes.

This April neither would give ground, resulting in both climatological features being stronger than normal, with a strong pressure gradient between the two.

As is typical in spring, the storm tracks, in general, extended from the eastern North Atlantic into the Norwegian Sea. While most storms were of the moderate variety, there were a couple worthy of mention. Both created havoc in the waters south of Iceland during the last week of the month.

One of these storms came out of Long Island Sound on the 17th, while the other formed southeast of Greenland on the 22nd. The Long Island storm began as a frontal wave to the west of a large 1032–mb High, which threatened to impede its progress. However, the Low, moving across the Gulf Stream, began to develop a recognizable circulation by the 18th as the High split into two centers and weakened. By the 19th the eastward–moving 1002–mb storm began to generate 20–to 30–kn winds. It was also starting to turn toward the northeast. By the 22nd, its 980–mb center crossed the 60th parallel near 20°W, where it was engulfed by a Low off the southeast coast of Greenland. This potent double–centered storm created weather problems for mariners from the Grand banks to Lands End. Gales in the 40–kn range were common as were seas of 10 to 12 ft. On the 23rd the Greenland center, moving southward, intensified to 958 mb while the Long Island center a few hundred miles to the northeast was at 962 mb. The effect of this intensification was dramatic. The ***Lagarfoss*** (64°N, 20°W) estimated east winds at 68 kn as did the ***Hvassafell*** nearby at 1800 on the 3rd. The ***Maria Gorthon*** (47°N, 31°W) ran into 20–ft seas. Conditions worsened the following day. The ***Kivach*** (60°N, 5°W), at 0600, measured 54–kn east southeasterlies and 3 hr later the LF3J (61°N, 2°E) ran into 57–kn northerlies. Seas were in the 10– to 20–ft range. Storm force winds continued into the 25th as the Greenland center took off to the northeast and weakened. While the 958– mb Long Island center assumed control near 60°N, 25°W. However, by the following day it began to weaken as it made its way toward the Orkney Islands.

During this period of intense cyclonic activity over the northern shipping lanes, a subtropical storm had developed and was being watched north of the Lesser Antilles. It weakened on the 26th. Had it acquired tropical characteristics, however, it would have become Andrew.

Casualties– The bulk carrier ***Seavenus*** reported heavy weather damage on a voyage from Quebec to Russia. The bulk carrier ***Ozark*** was surveyed for heavy weather damage off the Port of Spain. The damage occurred near 27°N, 55°W. On the 25th the Mv ***Erika Bojen***

Satellite Data Services Division

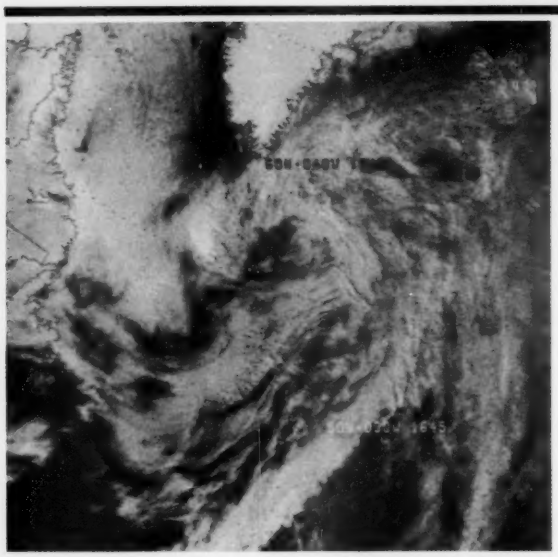
This is a visual photograph from the NOAA 11 satellite taken at about 1430 on the 23rd of April. This was one of two powerful low pressure centers assoicated with this storm. At this time its pressure was at 958 mb, while the second center a few hundred miles to the northeast was at 962 mb.

ran aground outside of the port of Figueira da Foz in high seas. The six crewmen were removed by helicopter. The Ro-ro ***Mekhanik Evgrafov*** collided in dense fog on the 25th with the ***Seabreeze One*** in the northern North Sea. The ***Seabreeze One*** was severely holed. The Mv ***Vltava*** suffered heavy weather damage on the 18th while enroute from Flushing to Sorel.

May—By this time of the year the climatic feature known as the Icelandic Low is usually hard to find, but not this year. A 1008-mb center was located off the southeast Greenland coast, and it generated pressure anomalies down to -10 mb, which means either more storms than normal or stronger storms than normal. This year it appears to be the former. The Azores-Bermuda High took up its customary position over the central North Atlantic.

The month opened with a large 1036-mb High centered near 40°N, 25°W. It was flanked to the northeast by a 988-mb Low and to the west by a 990-mb Low. The pressure gradient to the northeast was strong enough to create gales as testified to by the British Ocean Station Vessel ***Cumulus*** near 57°N, 19°W. The same thing was true of the storm to the west which was moving over the Grand Banks. To the south of its center there were several reports of 30- to 40 -kn winds. Fortunately, both systems were short lived, but the double-barreled High remained. This High stalled over the eastern North Atlantic, which resulted in Lows being shunted into the Denmark Strait. On the 3rd the Grand Banks storm reintensified to 976 mb just west of Iceland for a brief period. It continued northeastward but once through the Denmark Strait on the 5th it split into two centers and slowly weakened. Several vessels encountered gales on the 5th. The High expanded and strengthened to 1040 mb the following day. Two low pressure centers remained, one in the Denmark Strait and another in the Norwegian Sea. Even as late as the 8th, the DUMN2 reported 35-kn winds near 58°N, 45°W.

Another Low from Labrador moved eastward across the North Atlantic from the 9th through the 12th and by the end of the period its central pressure was down to 984 mb and the storm was generating gales southeast and south of its center. By this time the large High to the south was breaking up and weakening. However by the 13th it was reinforced by several surges from the Canadian Maritimes. This High slowed and spread out across the subtropics once again forcing the weak to moderate Lows to remain in the northern latitudes. High pressure remained the weather story into the second half of the month. On the 19th a 988-mb Low was centered in the Labrador Sea with a cold front trailing southwestward. It remained nearly stationary, pinned in by two Highs to the south. The pressure gradient between the systems resulted in near gale force winds along the frontal boundary. On the 22nd a 988-mb Low, which had originated in western Canada, flared up off the Labrador coast. The following day the ***Dettifoss***, close to the center, ran into 45-kn east southeasterlies and the C6CT2 hit 35-kn southwesterlies some 350 mi south southeast of the center. Winds of



Satellite Data Services Division

This NOAA 11 visual satellite photograph shows one of two storms that were flanking a large high pressure system as May opened. This was taken on the 2nd of May at about 1645.

40 kn were reported by the ***Wladyslaw Sikorski*** with the passage of the associated cold front. The central pressure dipped to 968 mb as the storm crossed the 50th parallel near 35°W that same day. It remained potent into the 24th and gale reports were common within 600 mi of its center, which was moving eastward. The storm began to fill on the 26th, but it maintained its identity until the end of the month when it moved into the English Channel.

Casualties— The Belgian vessel ***Semois***, chartered by a diving club and carrying a three crewmen and eleven divers sank off Alicante (Spain) in gales and rough seas. The vessel had developed a couple of leaks.

June— The usual climatological pattern over the North Atlantic in June is a large Azores-Bermuda High with just the weak remnants of an Icelandic Low. This June was nearly normal except that the High bulged into the North Sea resulting in positive pressure anomalies over England and Scandinavia. A look at the track charts shows a concentration of cyclonic activity south of the Grand Banks and in the Denmark Strait. Most of the systems were typical of late spring and summer being of the weak to moderate variety.

On the 6th a 986-mb Low was spotted in the Denmark Strait. It was actually the combination of a Low that had formed over New Jersey and one that had developed in the strait itself. At 0600 on the 6th the LYBG (58°N, 36°W) measured 52-kn west southwesterlies in 13-ft seas. The system meandered through the Denmark Strait for several days but as a weak system. By the 10th a 984-mb Low showed up off the east coast of Newfoundland after coming to life in the Gulf of St. Lawrence the previous day. This system remained well organized as it move northeastward across Iceland and finally into the Barents Sea over the next 5 days. On the 10th the gradient between the Low and a large 1028-mb High to the southeast was tight enough to cause strong winds to the south of the Low's center. Winds in the 40- to 45-kn range were common. On the 12th an atmospheric wave along the front that trailed from the Low caused problems southeast of the Grand Banks. The ***Tillie Lykes*** (42°N, 46°W) measured 45-kn southwesterlies in 15-ft seas and similar reports were received from the ***Newark Bay*** and the ***Sanko Pioneer***. The wave fizzled on the 14th, but the Low continued its track to the Barents Sea.

On the 17th a 1042-mb High centered near 50°N, 25°W was dominating most of the North Atlantic. It split into two sections with a complex low pressure system in between which had several centers in the Denmark Strait and a front that stretched southwestward to several more centers. These systems created a few headaches and reports of winds in the 40-kn range were received. The portion of the system in the Denmark Strait organized into a 982-mb Low on the 19th as it moved northward along the Greenland coast. Land stations in Iceland were observing 30- to 40 -kn winds. High pressure continued to dominate the weather picture with several small Lows coming to life in the western North Atlantic and Denmark Strait during the third week in June. In the last week the High dropped into the subtropical regions allowing a series of moderate Lows to inhabit the area between the 40th and 50th parallels. The most serious of these occurred toward the end of the month when a 982-mb Low was analyzed off the Grand Banks. On the 30th the ***Pholas*** (47°N, 49°W) rn into 40-kn winds in 12-ft seas for the entire day.

Casualties—No reports were received.

North Pacific Weather
April, May, and June 1992

April—In the Pacific the broad subtropical High was weaker than normal while the Aleutian Low was split into two distinct centers, one over the Kamchatka Peninsula and the other in the Gulf of Alaska. In the Bering Sea, a ridge of high pressure bulged in from the Bering St. resulting in positive anomalies up to 10 mb. Neither segment of the Aleutian Low was particularly intense. All these climatic features were the result of a less than active month in the Pacific as far as storms were concerned. Those that did develop were of weak or moderate intensity.

The month opened with a 982-mb storm left over from March near 40°N, 165°E. A few ship reports of 40- to 45-kn winds were received on the 1st and 2nd, but they were scattered. The system quickly weakened. On the 8th a large 1044-mb High which had settled in over the Bering Sea expanded well into the central North Pacific. Its pressure gradient was tight enough to result in gales in both its southeast and southwest quadrants. For example the ***Sakaide Maru*** (53°N, 171°E) measured 44-kn east southeasterlies in 17-ft swells while the ***Tatekawa Maru*** (46°N, 179°W) at 1800 on the 9th measured 47-kn winds in 23-ft swells. This inverted ridge of high pressure extended to just north of the Hawaiian Islands for several days.

On the 11th, to the east of the high pressure ridge, a 984-mb Low developed near 40°N, 140°W. It generated some strong winds and rough seas along the west coast of North America for a few days before weakening near Vancouver Is. on the 14th. By this time it was replaced by a complex multicentered system that covered most of the North Pacific on the 14th and 15th. By the 16th it became more organized with a 972-mb center over the Alaskan Peninsula and a huge circulation that extended west to Kamchatka, east to the West Coast of North America and south to near the Hawaiian Islands. On the 16th the ***President Polk*** (49°N, 177°E) hit 40-kn winds in 25-ft seas while the ***Sea-Land Kodiak*** (50°N, 128°W) measured 57-kn winds in 15-ft swells. The system began to weaken on the 17th and a second center was analyzed along the southeastern coast of Alaska.

Another moderate system developed on the 17th near 33°N, 150°E. While its central pressure dropped only to 980 mb the fact that it was trapped between two Highs increased the pressure gradient to the point that gales were being reported to the west of its center. For example, the WFLH (39°N, 163°E) measured 40-kn west northwesterlies in 20-ft seas and these winds were confirmed by the YJZH9. The system moved eastward and weakened.

One of the longest-lived storms of the month developed well south of Tokyo on the 16th. After moving northeastward it skirted the 40th parallel on the 18th and 19th and then turned southeastward. While pressure fell to 982 mb during this period it began to weaken and by the 21st was up to 1012 mb. On the 22nd and 23rd it began to reintensify and head toward the Gulf of Alaska. By the 24th it was a 972-mb center crossing the 45th parallel near 140°W. The ***Suruga Maru*** (49°N, 138°W) measured 56-kn southerlies in 17-ft seas and several other vessels also reported storm force winds on the 125th. At 1200 the ***Galcier Bay*** (53°N. 138°W) hit 52-kn southerlies while battling 30-ft seas. Gales were being reported west of the center. Fortu-

nately, this intensity was short-lived and by the 26th the central pressure had risen to 986 mb as the system meandered through the Gulf of Alaska during the next several days.

Casualties—On the night of April 18th near Waglan Is., a mainland security vessel was damaged after colliding in heavy rain and fog with the cargo vessel ***ALS Express*** inside Hong Kong waters. No one was hurt. The refrigerated Mv ***Auckland Star*** reported heavy weather damage on the 13th and 14th while enroute from Ecuador to Korea.

May—From a climatological standpoint May was a most unusual month in the North Pacific. Positive pressure anomalies were found where the Aleutian Low resides and negative anomalies covered the subtropical area of high pressure. In other words, there were no predominant features or no concentration of highs and lows. A look at the track chart for cyclone centers shows them spread out across the Pacific north of 30°N. None were particularly intense.

The month opened with a large 1028-mb High covering a good portion of the eastern Pacific with a weak Low in the Gulf of Alaska and a developing Low off northern Hokkaido. Winds around the Hokkaido Low were reaching 30 kn. By the 2nd the northward moving Low deepened to 972 mb as gales were being reported south of the center, which was heading toward the Sea of Okhotsk. It slowed and weakened on the 3rd. The Gulf of Alaska storm was meandering through those waters and creating minor weather problems in the northeastern North Pacific and along a cold front which trailed southwestward to the Hawaiian Islands . The system persisted until the 5th. The following week was messy but amorphous with several weak, short-lived highs and lows developing and dissipating. Two large highs did assume temporary control of a good part of the North Pacific on the 9th and 10th while a 983-mb Low from the Sea of Japan was shunted across the Sea of Okhotsk and into the Bering Sea. A trough between the two Highs resulted in a couple of weak lows northwest of the Hawaiian Islands from the 10th to the 15th. One of these Lows on the 15th was intense enough to generate 20- to 30-kn winds within it circulation. The Highs broke down on the 17th, although another established a 1038-mb center over the Bering Sea while a 986-mb Low came to life east of Honshu. On the 17th at 1200 the ***Sea-Land Defender***, some 200 mi east of the center of the Honshu Low, hit 30-kn southeasterlies and the following day several vessels including the ***Century Leader No. 2*** were reporting winds in the 40-kn range. By the 19th the Honshu storm began to weaken and its circulation was taken over by a center to the south. Moving east northeastward this new storm generated winds to near gale force on the 21st as its center crossed the 45th parallel near 175°W. The following day the Pacific weather situation was a complex mess with a dozen different high and low pressure centers analyzed.

One of the Lows became organized enough to develop a 984-mb center on the 24th near 45°N and the Dateline. It generated gale force winds in its southwest quadrant where swells up to 15 ft were being reported. This storm was actually part of a larger circulation which had another center near the Gulf of Alaska and the entire system was dominating the weather of the eastern North Pacific north of about 35° to 40°N. A large 1025-mb High between California and Hawaii blocked the advance of the low pressure system for several days. The situation remained stagnant and the lows gradually weakened as the month's end approached.

During May no tropical cyclones developed over the Western North Pacific and South China Sea. Some 3 months has elapsed since Ekeka was observed in February.

Casualties—There were none reported in our usual sources.

June—Like the Atlantic the large subtropical high was in place on the climatic charts. However the Aleutian Low, unlike the Icelandic, did not fade without a struggle. It was more intense than normal resulting in negative anomalies down to about -6 mb over the central Aleutians. A quick glance at the track chart for the month will confirm that this was the center of cyclonic activity. It is also apparent from this chart that several storms moved across the Pacific, along the 40th parallel and eventually turned recurved into the Gulf of Alaska.

The first week of the month a series of weak lows and highs dominated the North Pacific and nothing really organized. Then on the 8th the ***California Mercury*** (39°N, 171°E) reported a measured 54-kn west northwesterly in 10-ft swells south of a 988-mb

Satellite Data Services Division

On the 4th of June at about 2100 Tropical Storm Agatha was spotted coming off the coast of Mexico . This was a banner year in the eastern North Pacific, where at press time they had run through the entire alphabet of names for the first time ever.

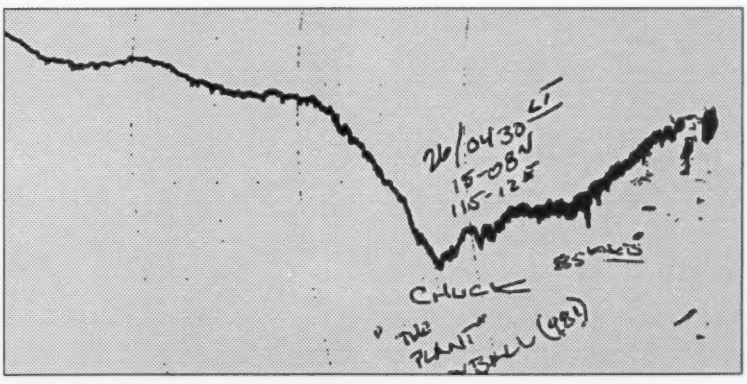
Low near 40°N, 170°W at 0000. Several gale reports were received to the west of the east northeastward moving center. The storm jogged northward and kept its intensity on the 9th and 10th. Once into the Bering Sea, it turned a clockwise loop and weakened by the 12th. At 2100 on the 10th the *Niitaka Maru* (49°N, 162°E) encountered 40-kn westerlies in 13-ft seas. Meanwhile, by the 14th a system that had formed off Tokyo on the 8th and moved into the Bering Sea on the 13th, intensified. The following day it was a 988-mb Low generating gales to the west and south of its center. The *Pacduke* (54°N, 180°) measured 40-kn winds in 17-ft seas at 0000 on the 14th. On the 16th this system was absorbed by a 984-mb Low which moved into the Bering Sea, turned two clockwise loops and then moved into the Gulf of Alaska by the 23d. On the 17th the *Jade Forest* hit 42-kn northwesterlies near 53°N, 179°W.

On the 25th a 987-mb Low was analyzed in the southern Bering Sea after forming 2 days before near 47°N, 167°E. Winds around its center were running about 20 to 30 kn as it meandered through the Bering Sea for the next several days.

The big news of the month in the Pacific was Typhoon Bobbie, which raged across the western Pacific during the last week of June. Bobbie formed on the 23rd about 670 mi east southeast of Manila. Moving northwestward it intensified to a tropical storm the following day and attained typhoon strength on the 25th some 225 mi east of Manila. Bobbie turned northward on the 26th and reached peak intensity the next day. The typhoon passed just south of Okinawa on the 29th and dropped to severe tropical storm intensity about 350 mi east northeast of Okinawa the following morning. It finally turned extratropical some 100 mi south of Tokyo on the night of the 30th.

While Bobbie was intensifying east of the Philippines, Chuck was forming about 160 mi southwest of Manila on the 24th. It moved across the South China Sea and intensified to typhoon strength on the 27th. After hitting Hainan Is. on the 28th, Chuck landed over northern Vietnam on the 29th.

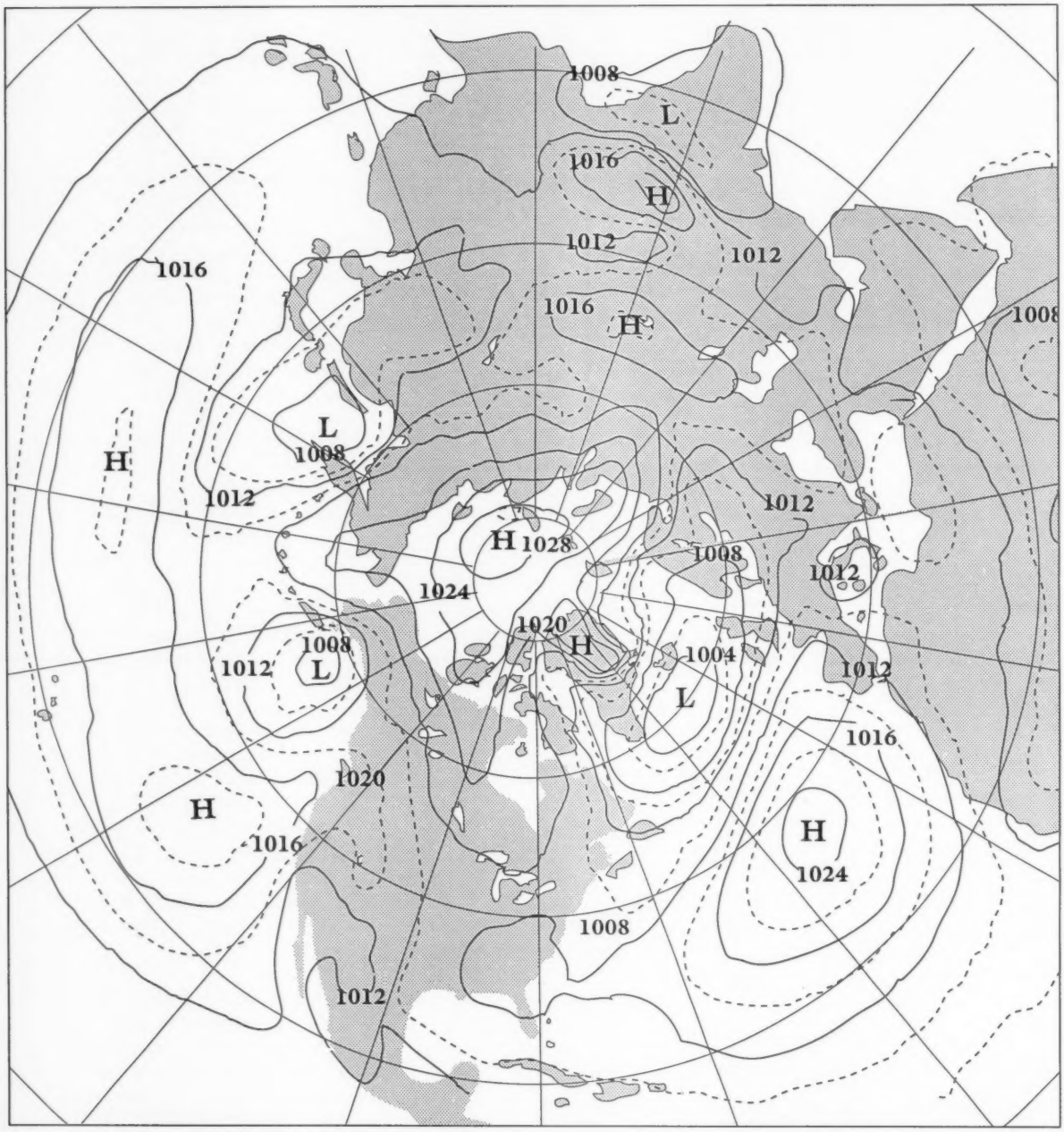
The third tropical cyclone of the month was Deanna. It came to life some 460 mi southeast of Yap Is. on the 28th and headed northwestward. Deanna remained poorly organized and showed little development as the month came to an end and the tropical storm remained east of the Philippines.



The Liberty Star traveling from Portland to Singapore came under the influence of Typhoon Chuck on June 26th. The recorded a low pressure of about 981 mb at 0408 near 15°N, 115°E. They also recorded 85-kn winds.

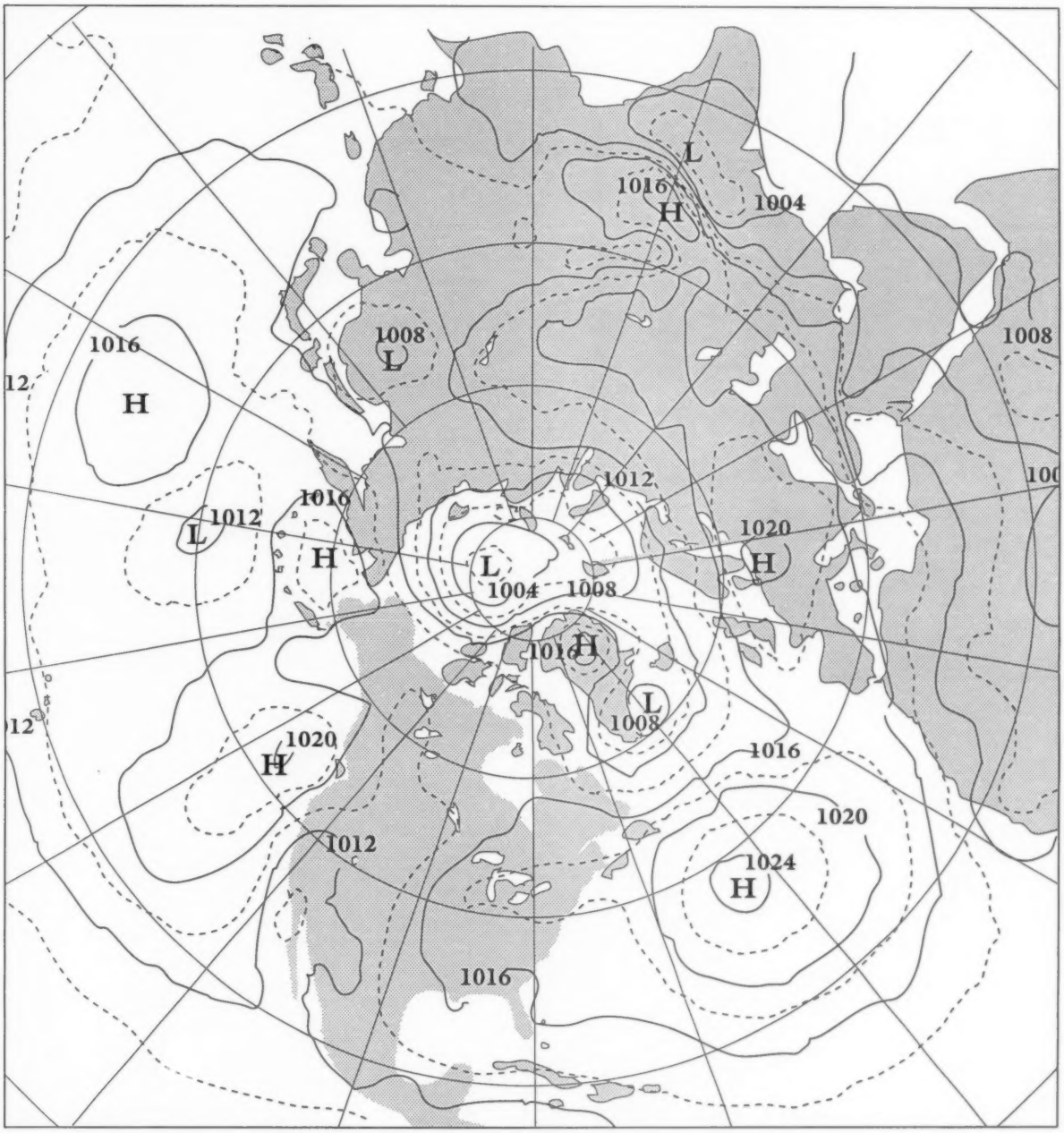
Casualties— In Hainan during Chuck one person was killed and 19 others injured. An estimated 29, 000 homes were destroyed or damaged. There were reports of 89 fishing boats which capsized during the storm. In northern Vietnam the death toll was five with nine others missing. Several ships were severely damaged.

April 1992



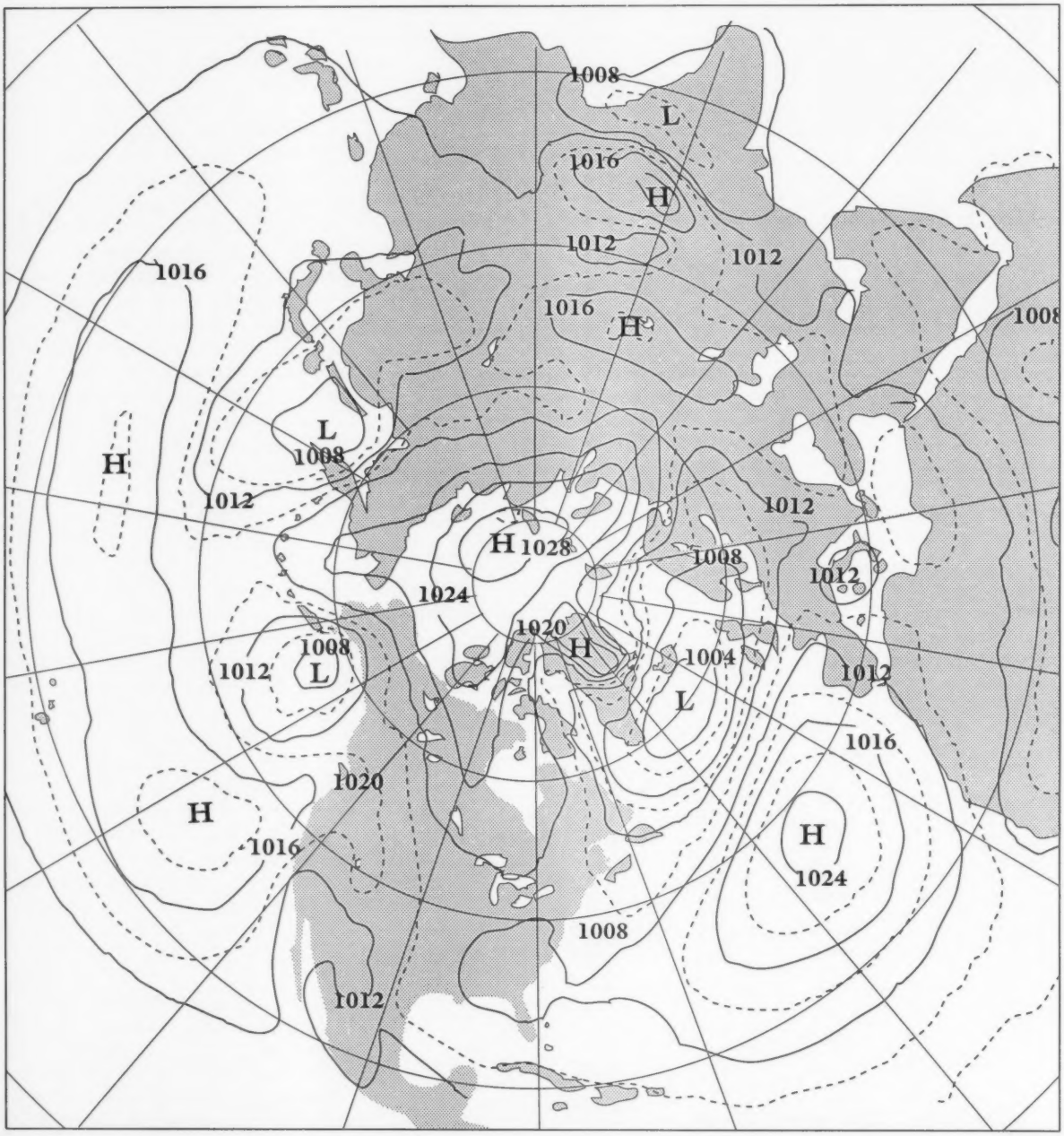
These Charts were Provided by John Kopman and Vernon Kousky of the Climate Analysis Center from the *Climate Diagnostics Bulletin*.

May 1992



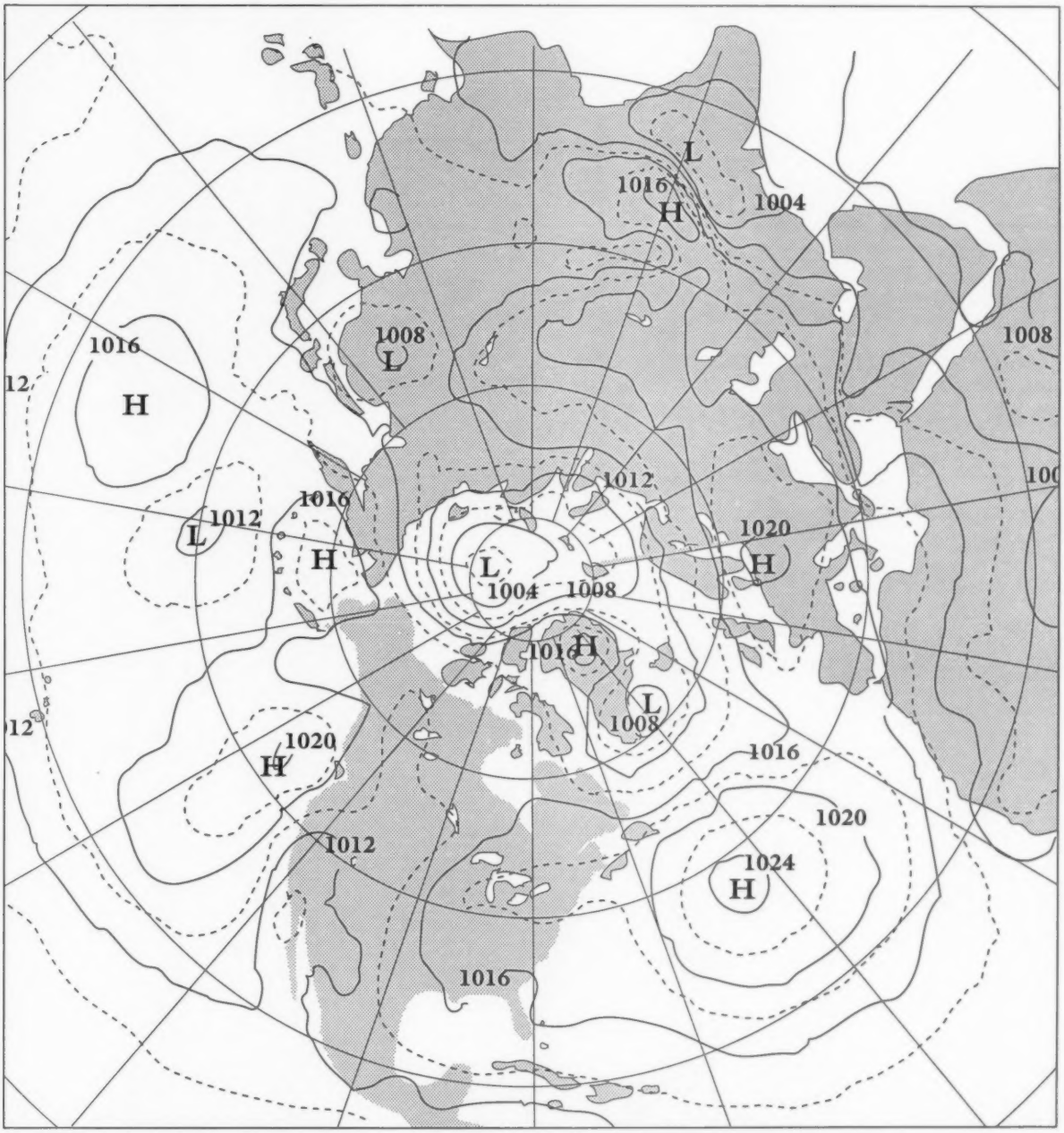
These Charts were Provided by John Kopman and Vernon Kousky of the Climate Analysis Center from the *Climate Diagnostics Bulletin.*

April 1992



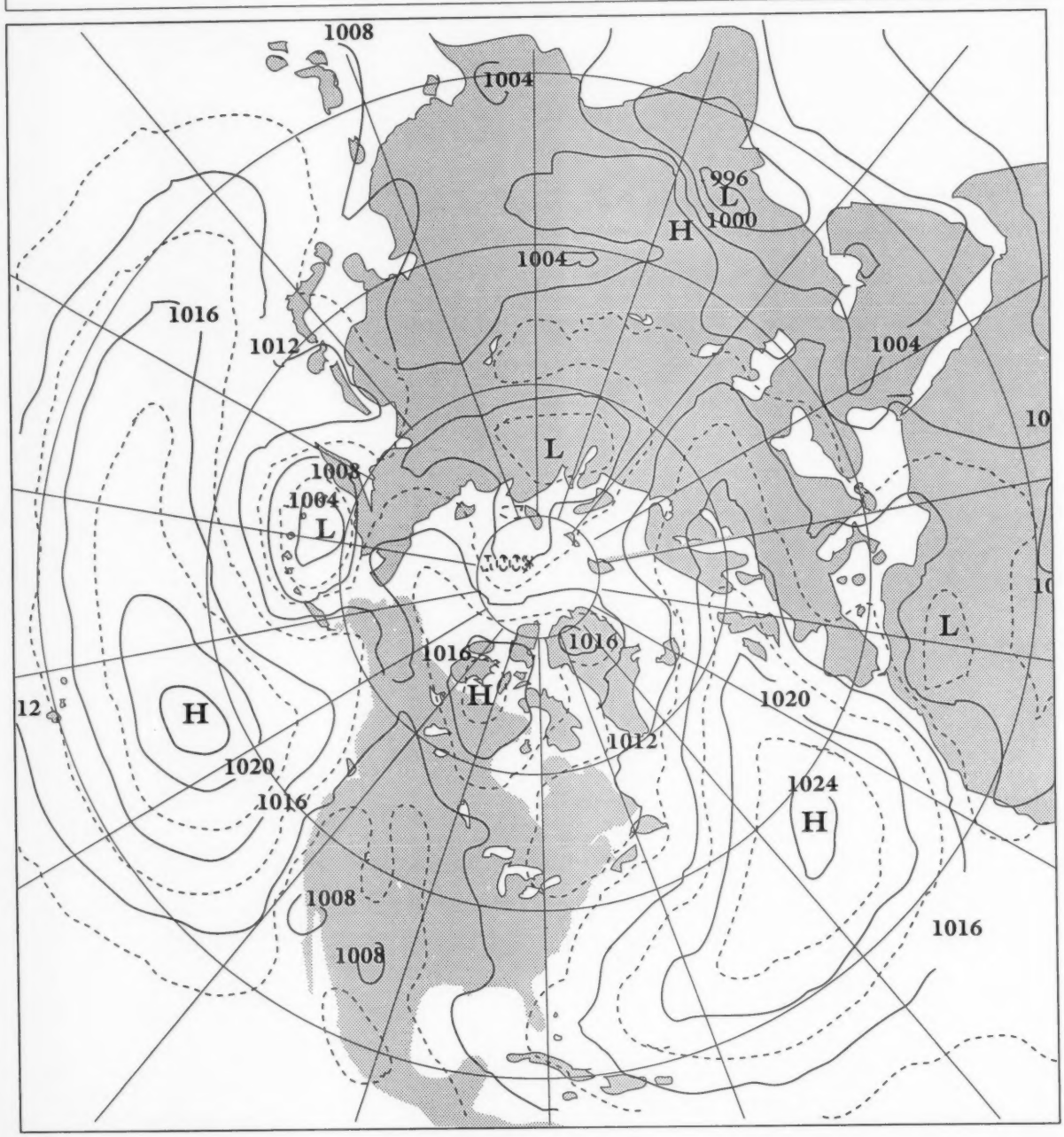
These Charts were Provided by John Kopman and Vernon Kousky of the Climate Analysis Center from the ***Climate Diagnostics Bulletin***.

May 1992



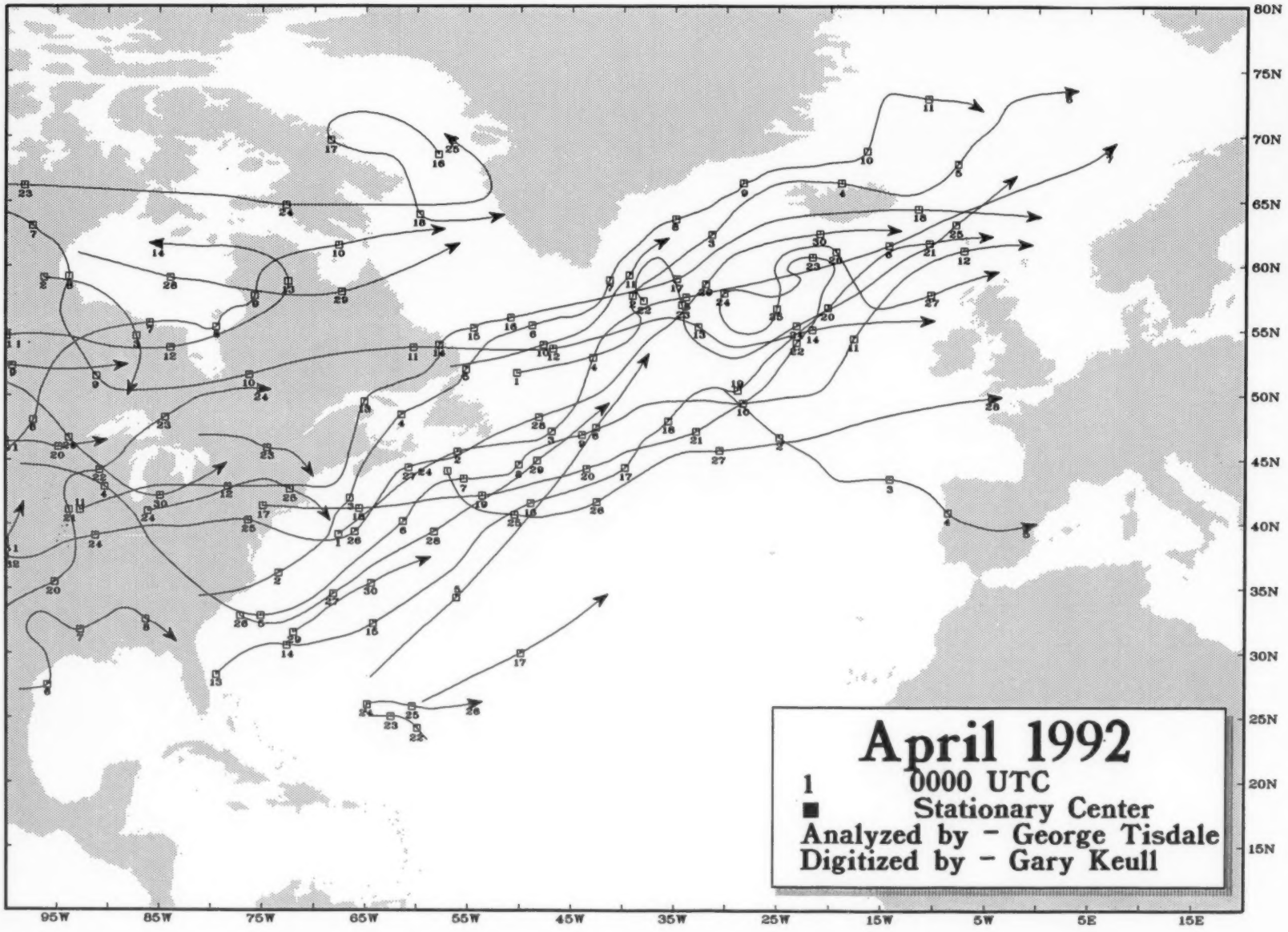
These Charts were Provided by John Kopman and Vernon Kousky of the Climate Analysis Center from the *Climate Diagnostics Bulletin.*

June 1992

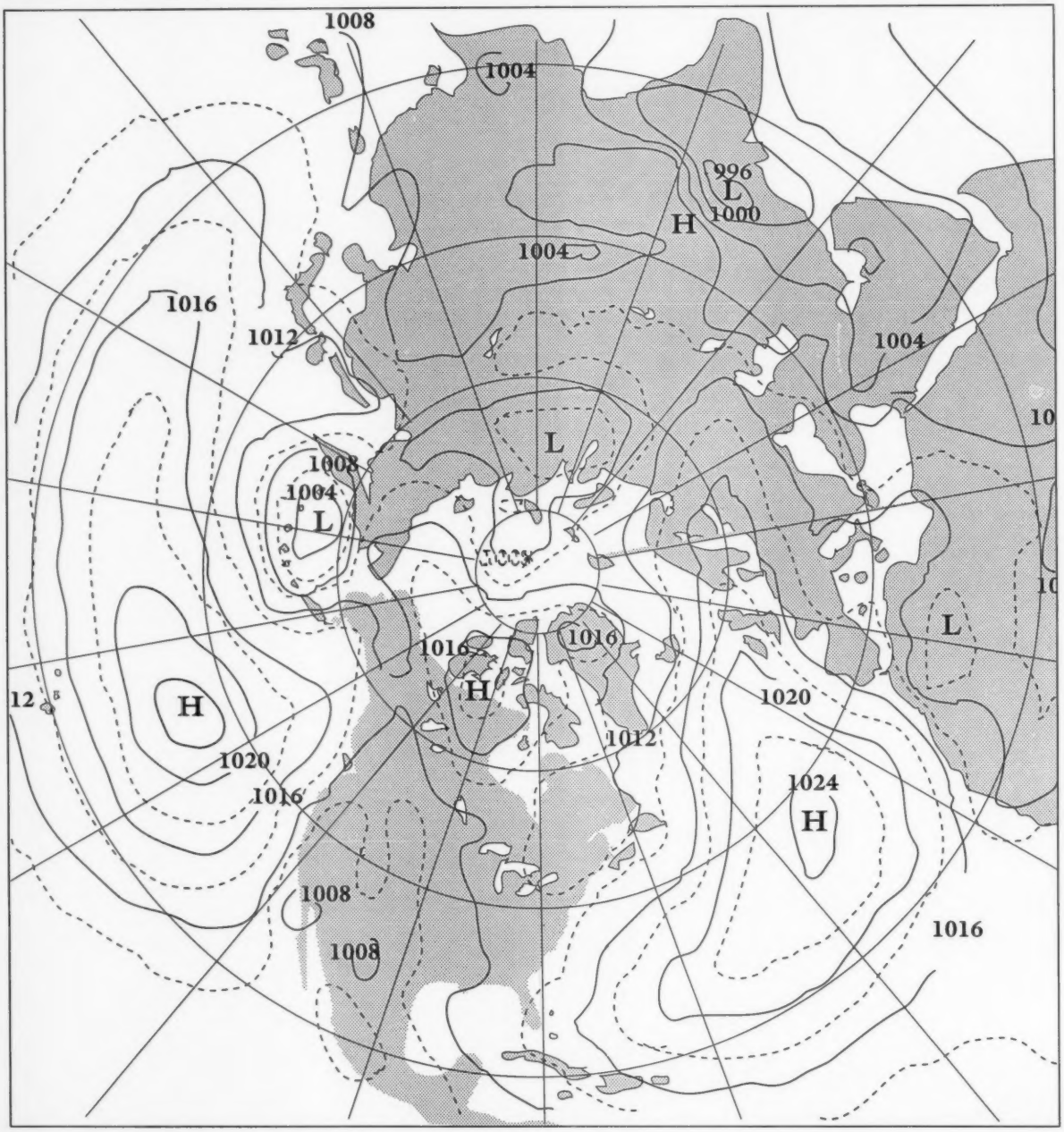


These Charts were Provided by John Kopman and Vernon Kousky of the Climate Analysis Center from the ***Climate Diagnostics Bulletin.***

Principal Tracks of Cyclones Centers at Sea Level, North Atlantic

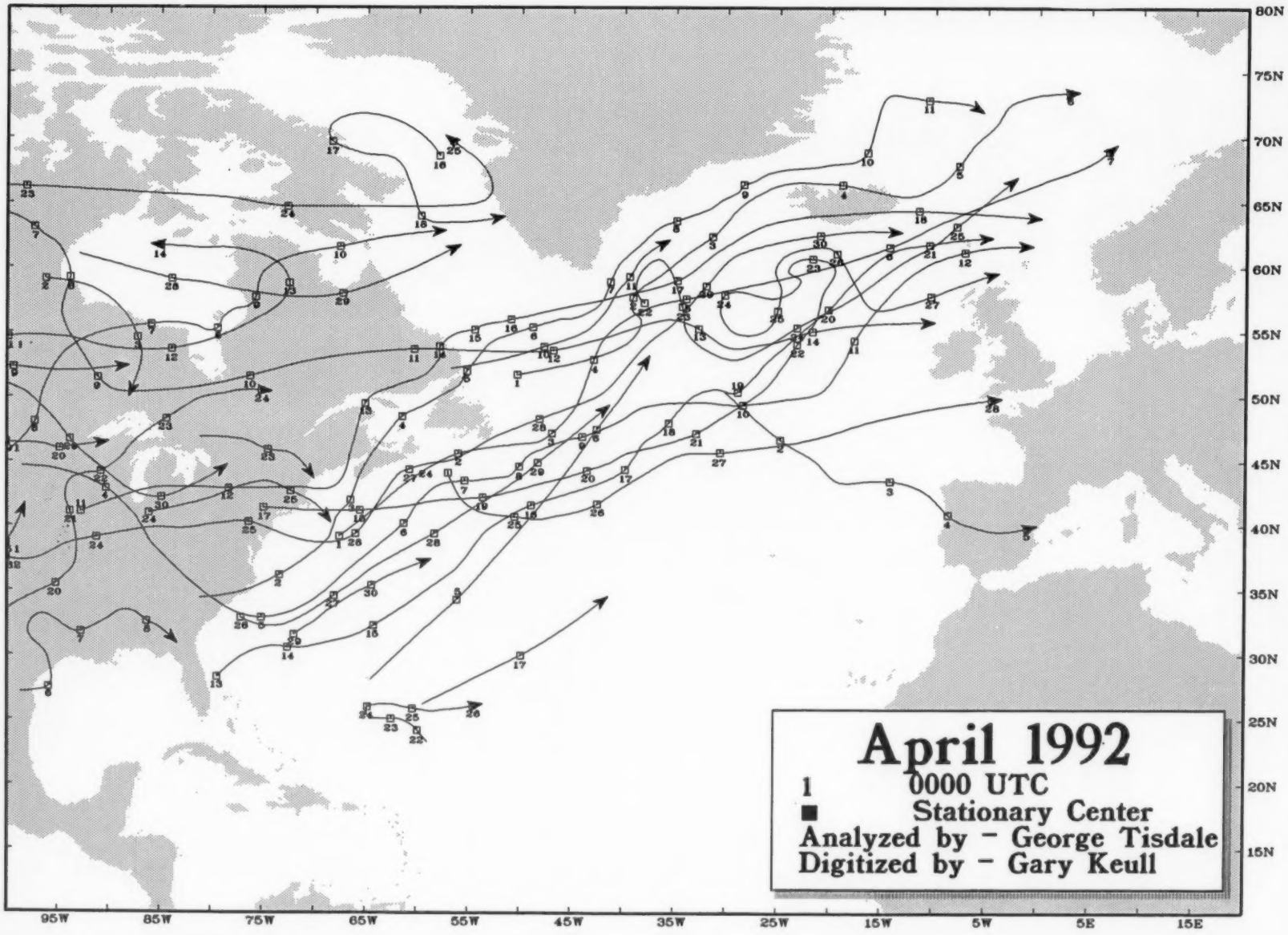


June 1992

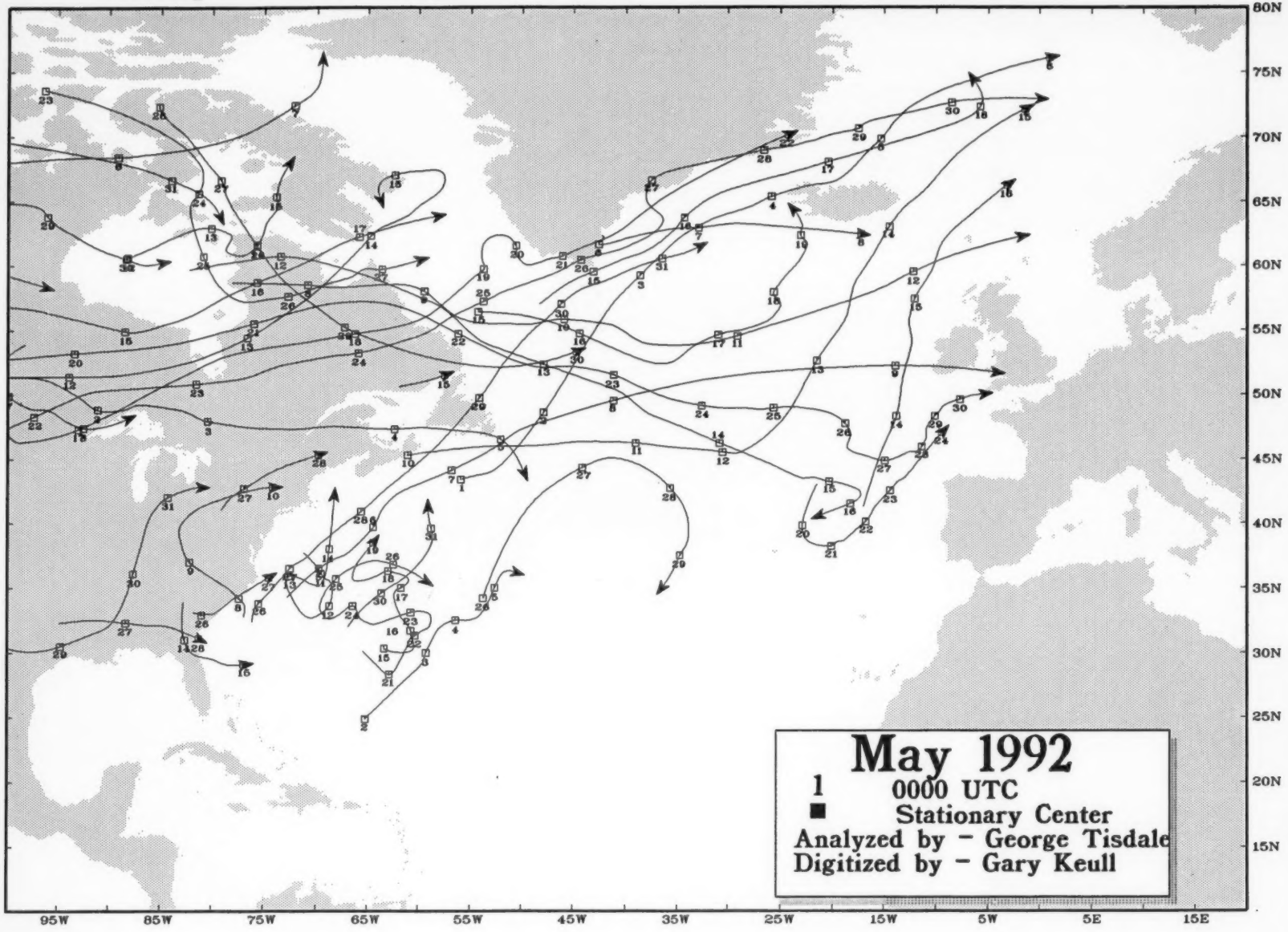


These Charts were Provided by John Kopman and Vernon Kousky of the Climate Analysis Center from the *Climate Diagnostics Bulletin.*

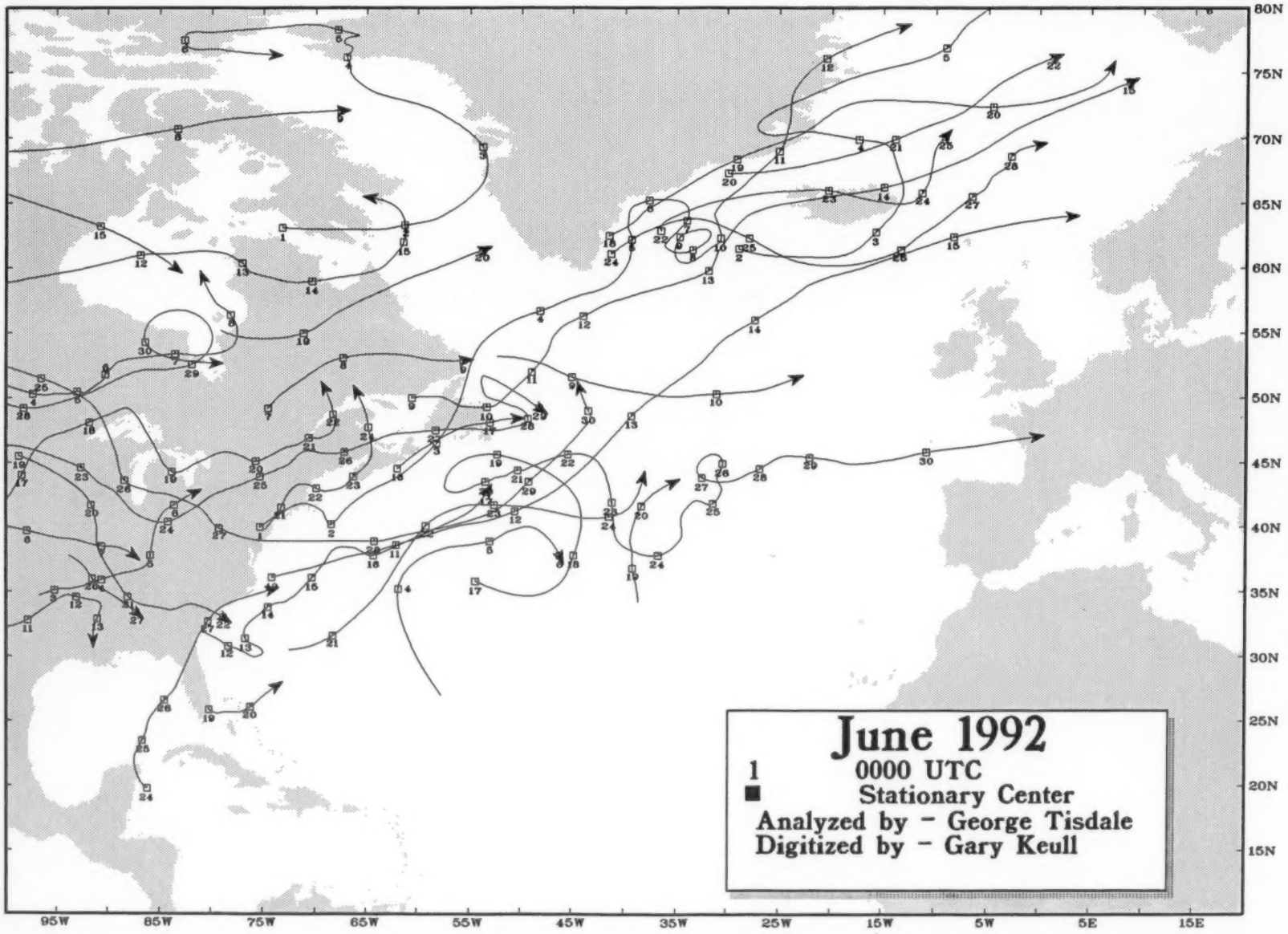
Principal Tracks of Cyclones Centers at Sea Level, North Atlantic



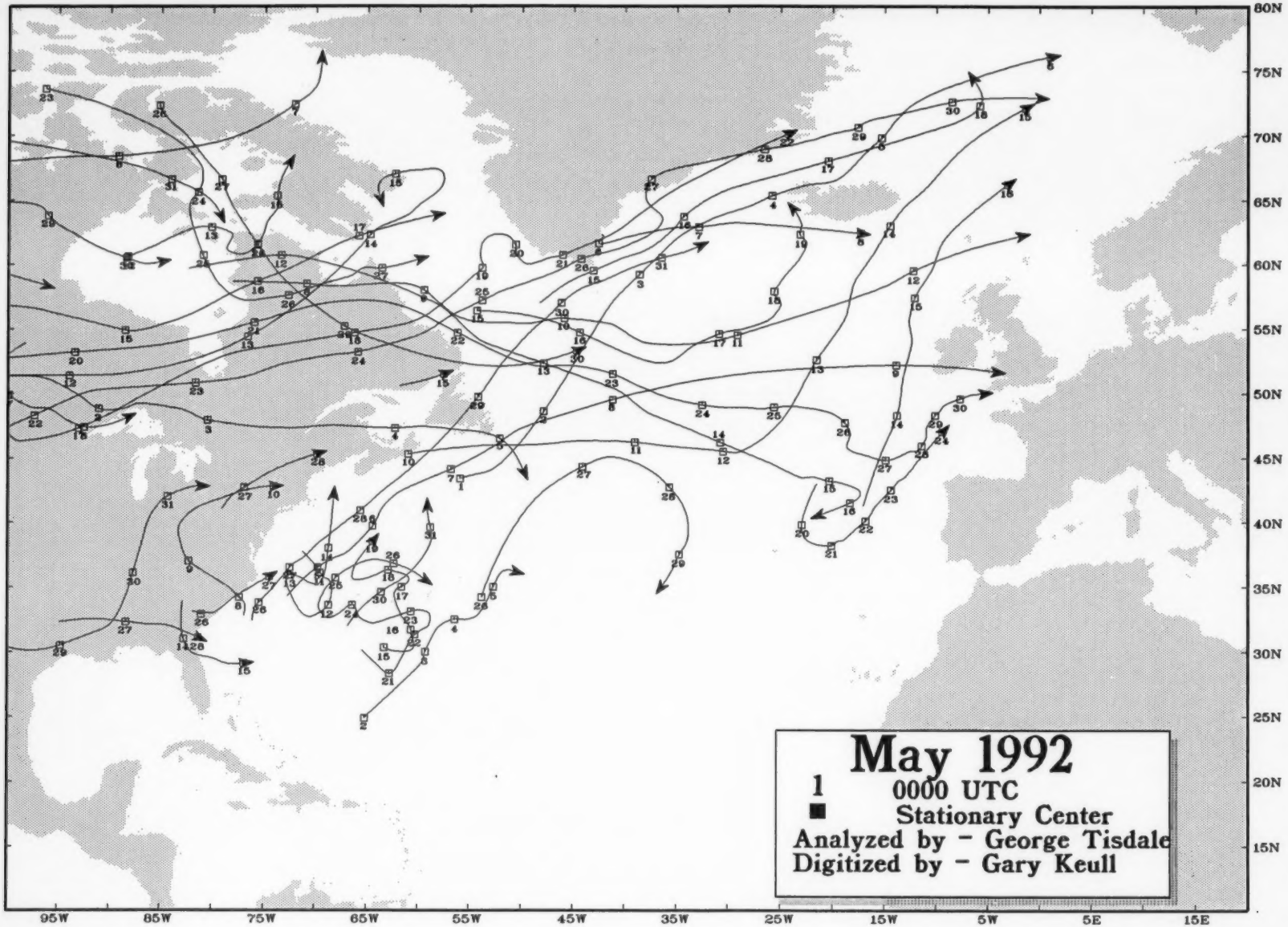
Principal Tracks of Cyclones Centers at Sea Level, North Atlantic



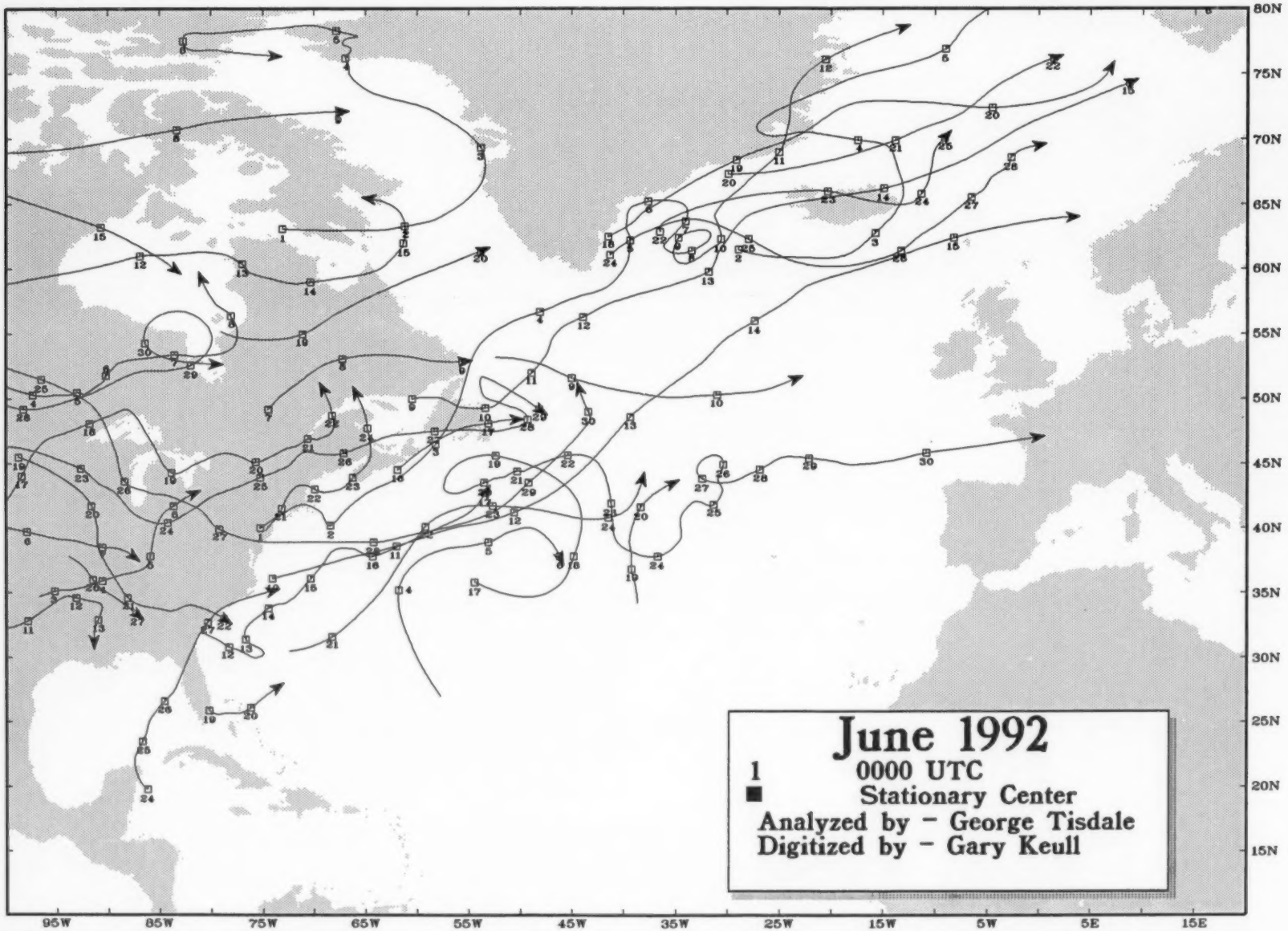
Principal Tracks of Cyclones Centers at Sea Level, North Atlantic

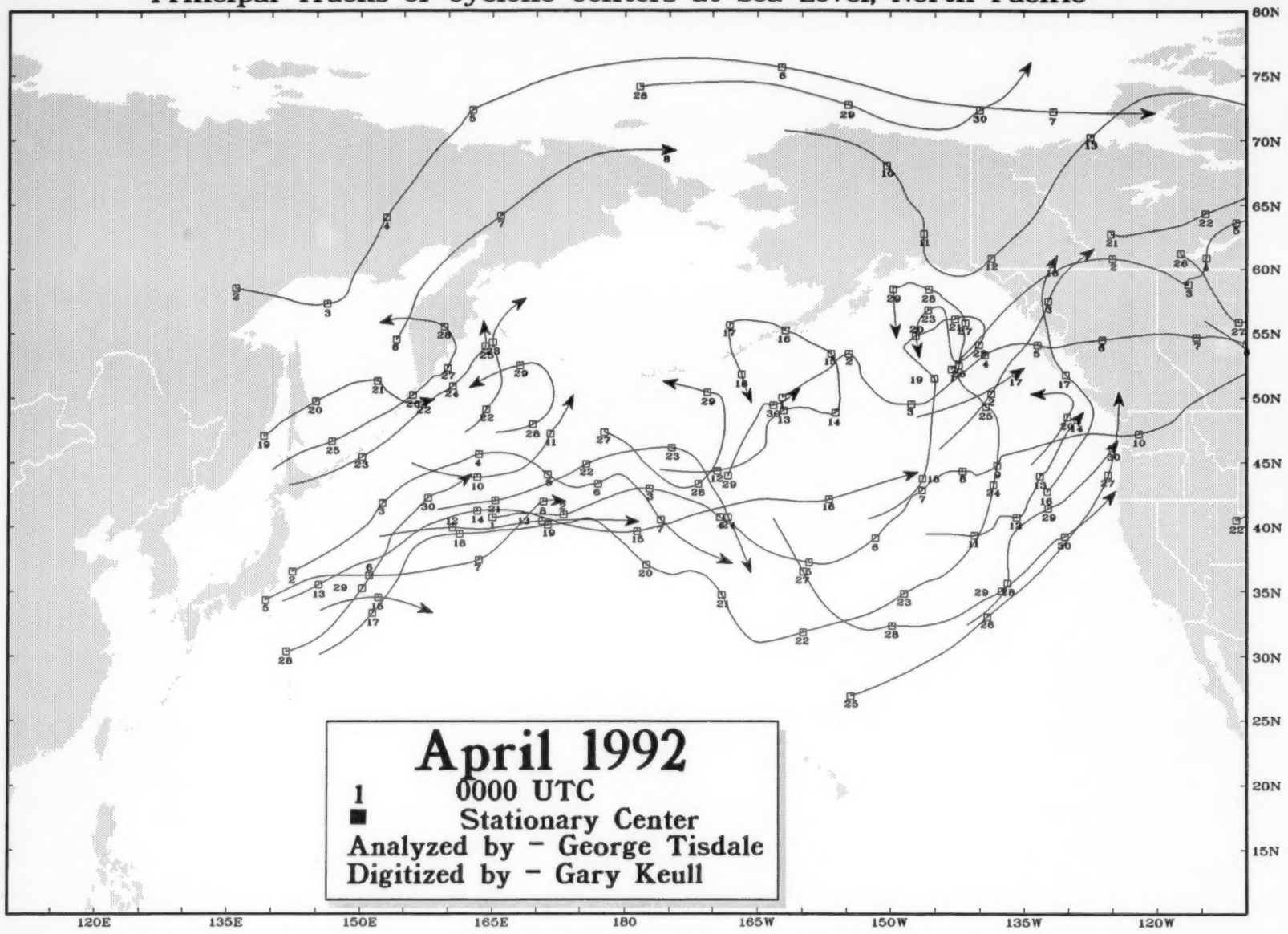


Principal Tracks of Cyclones Centers at Sea Level, North Atlantic

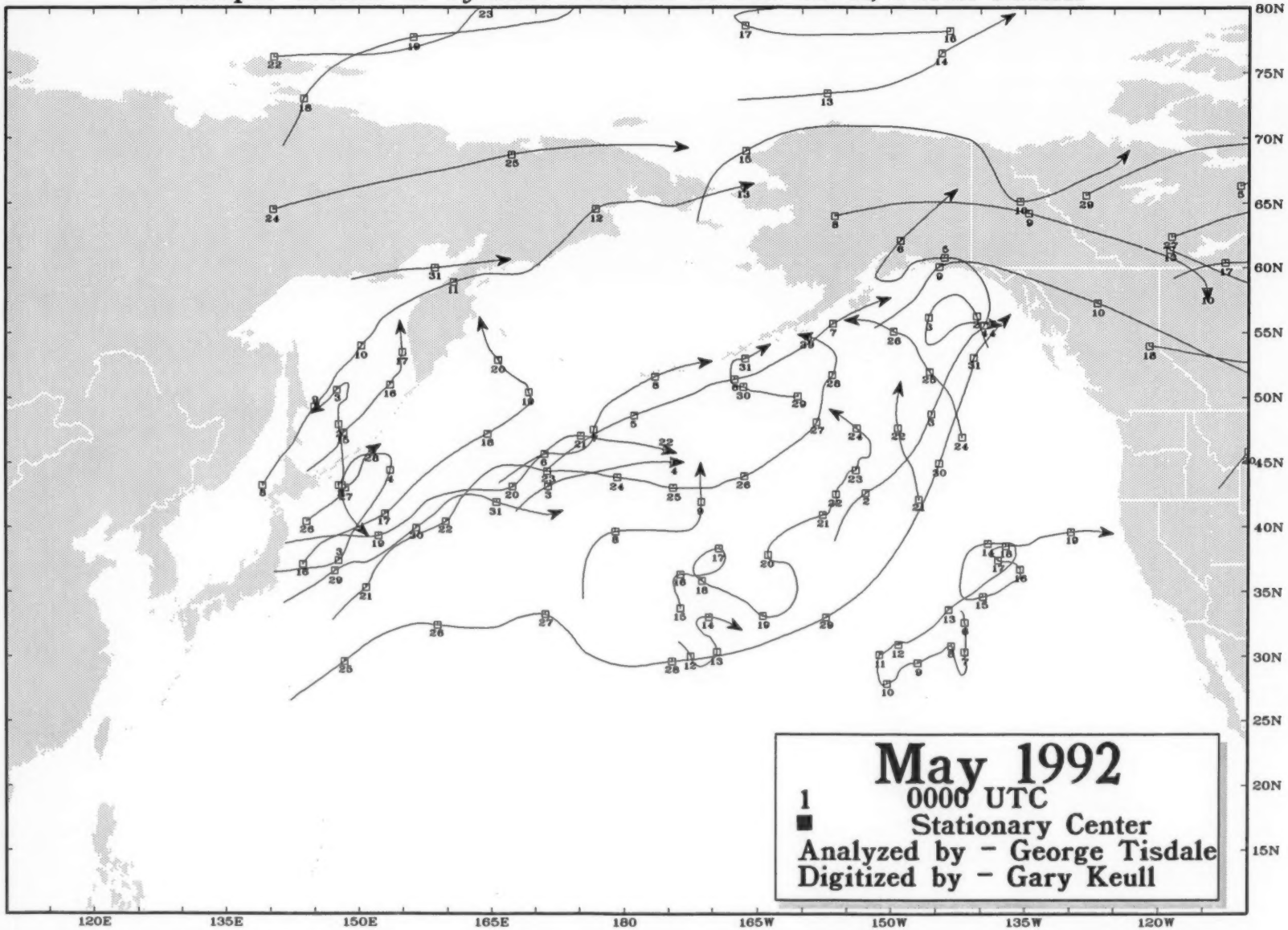


Principal Tracks of Cyclones Centers at Sea Level, North Atlantic

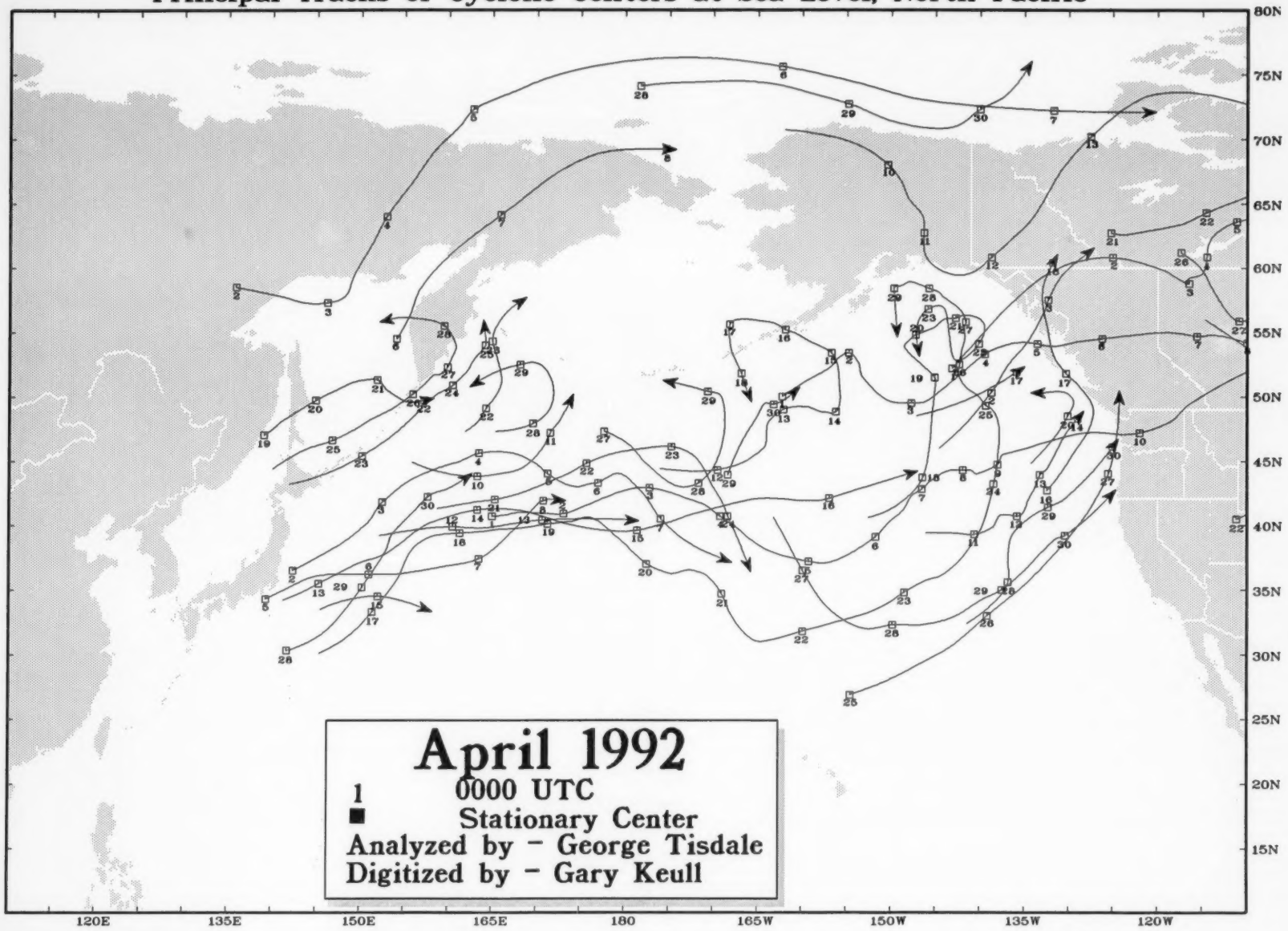



Principal Tracks of Cyclone Centers at Sea Level, North Pacific
80N
75N
70N
65N
60N
55N
50N
45N
40N
35N
30N
25N
20N
15N
120E
135E
150E
165E
180
165W
150W
135W
120W
April 1992
0000 UTC
Stationary Center
Analyzed by - George Tisdale
Digitized by - Gary Keull

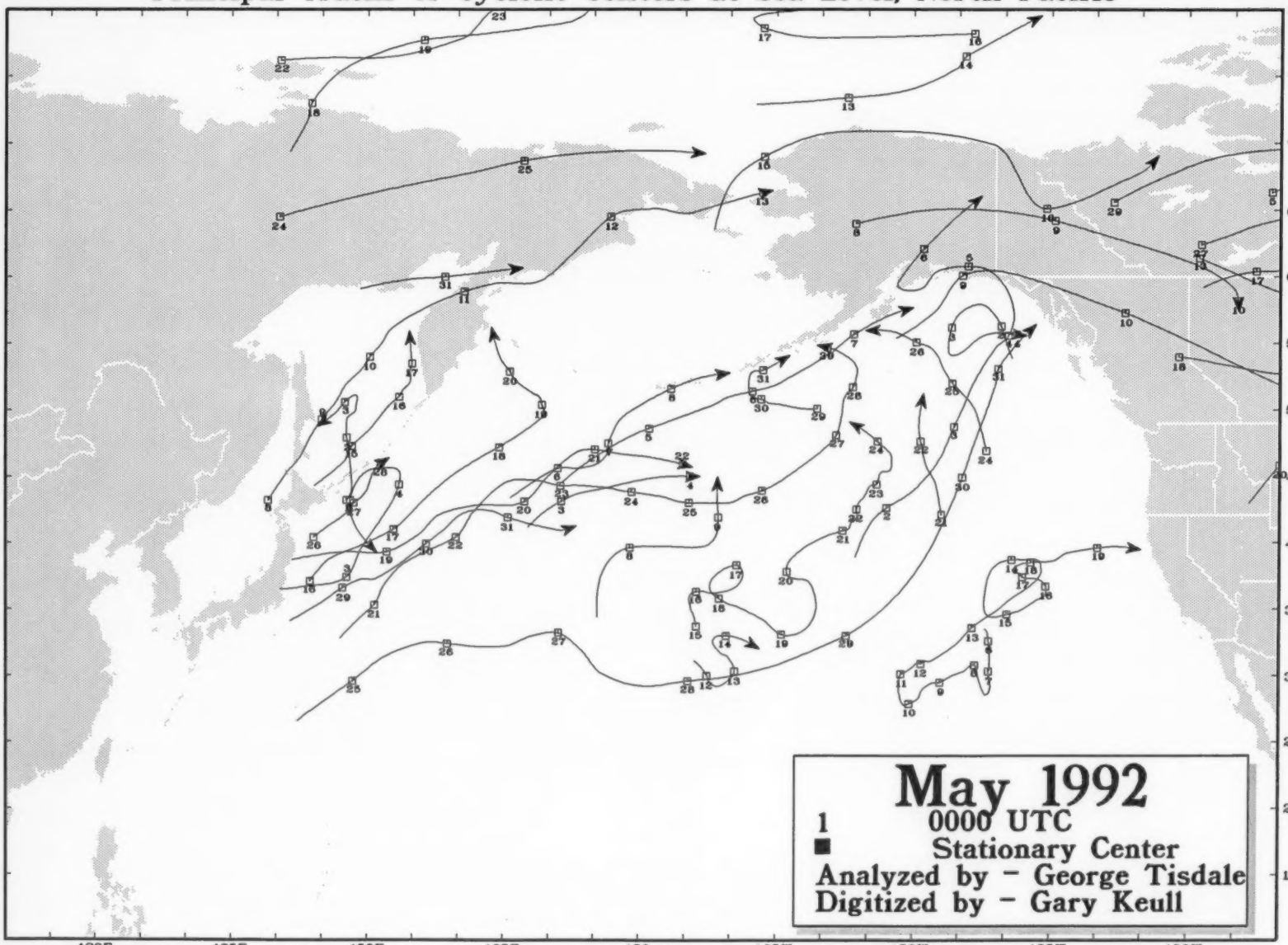
Principal Tracks of Cyclone Centers at Sea Level, North Pacific



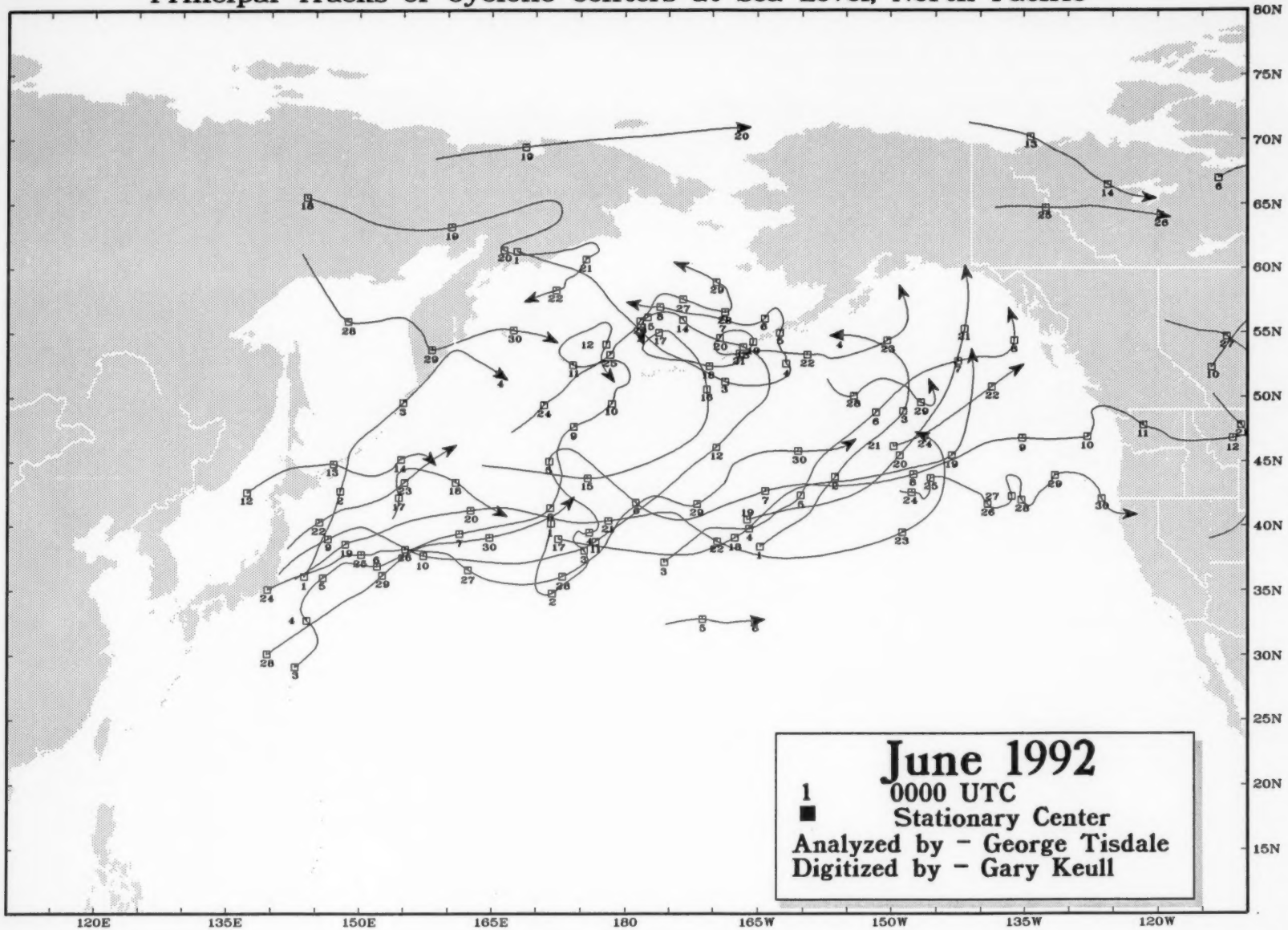
Principal Tracks of Cyclone Centers at Sea Level, North Pacific



Principal Tracks of Cyclone Centers at Sea Level, North Pacific



Principal Tracks of Cyclone Centers at Sea Level, North Pacific



April, May, and June 1992

	RADIO	MAIL
1ST LT ALEX BONNYMAN	21	5
1ST LT BALDOMERO LOPEZ	47	44
1ST LT JACK LUMMUS	8	16
2ND LT. JOHN P. BOBO	11	
A. V. KASTNER	152	
ACE ACCORD	29	12
ACT 5	136	
ACT 7	215	
ACT I	174	
ADABELLE LYKES	85	153
ADDIRIYAH	49	49
ADRIAN MAERSK	19	16
ADVANTAGE	12	20
AGNES	38	58
AIDE	2	3
AINO	31	4
ALASKA RAINBOW	83	129
ALBERT MAERSK	28	42
ALDEN W. CLAUSEN	9	87
ALEMANIA EXPRESS	16	
ALLIGATOR COLUMBUS	39	38
ALLIGATOR EXCELLENCE	64	
ALLIGATOR FORTUNE	49	
ALLIGATOR GLORY	37	37
ALLIGATOR HOPE	57	154
ALLIGATOR JOY	44	39
ALLIGATOR LIBERTY	51	
ALLIGATOR PRIDE	55	68
ALLIGATOR TRIUMPH	52	15
ALMERIA LYKES	70	17
ALPENA	85	126
ALTAMONTE	25	9
AMER HIMALAYA	26	
AMERICA EXPRESS	93	
AMERICA STAR	166	
AMERICAN CONDOR	59	73
AMERICAN CORMORANT	9	
AMERICAN EAGLE	36	49
AMERICAN FALCON	62	126
AMERICAN KESTREL	25	
AMERICAN MARINER	16	58
AMERICAN REPUBLIC	37	25
AMERICAN TRADER	75	46
AMERICAN VETERAN	12	
AMERICANA	31	70
AMERIGO VESPUCCI	9	
ANDERS MAERSK	35	95
ANIKA,GERMANY	53	74
ANNA MAERSK	51	69
ARABIAN SENATOR	142	
ARCO ALASKA	16	24
ARCO ANCHORAGE	38	47
ARCO CALIFORNIA	35	57
ARCO FAIRBANKS	25	13
ARCO INDEPENDENCE	23	7
ARCO JUNEAU	15	9
ARCO SAG RIVER	14	33
ARCO SPIRIT	25	68
ARCO TEXAS	42	54
ARCTIC OCEAN	14	67
ARCTIC TOKYO	20	111
ARGONAUT	37	50
ARIES	9	
ARILD MAERSK	9	20
ARMCO	76	88
ARNOLD MAERSK	16	
ARTHUR M. ANDERSON	147	158
ARTHUR MAERSK	63	73
ASHLEY LYKES	55	
ASIAN SENATOR	83	
ASPEN	48	146
ASTRO JYOJIN	82	172
ATIGUN PASS	15	
ATLA	16	75
ATLANTA BAY	15	
ATLANTIC CARTIER	58	
ATLANTIC COMPASS	96	
ATLANTIC CONVEYOR	95	
ATLANTIC OCEAN	102	119
ATLANTIS II	40	12
AUSTRAL RAINBOW	30	
AXEL MAERSK	59	40
AYA II	148	
B.T. ALASKA	66	199
BAAB ULLAH	2	
BACTAZAR	28	109
BAHIS MAGDALENA,PANAMA	119	166
BALTIMORE TRADER	23	50
BAY BRIDGE	157	186
BEBEDOURO	33	
BELGIAN SENATOR	37	
BIBI	113	
BLUE SKY	52	
BOGASARI LIMA	338	
BOHOL SAMPAGUITA	13	
BONN EXPRESS	33	
BRAVADO	99	
BRIGIT MAERSK	15	
BROOKLYN BRIDGE	90	134
BROOKS RANGE	69	57
BROOKS RANGE,USA	33	
BUCKEYE	99	127
BUFFALO	13	
BUNGA KANTAN	33	
BUNGA KENANGA	39	
BURNS HARBOR	266	466
BUYER	20	31
C.W. KITTO	77	
CALCITE II	52	54
CALIFORNIA APOLLO	27	
CALIFORNIA CERES	58	
CALIFORNIA GALAXY	80	
CALIFORNIA HERMES	51	13
CALIFORNIA ORION	122	115
CALIFORNIA STAR	166	
CALIFORNIA TRITON	116	94
CALIFORNIAN,USA	16	85
CANADIAN RAINBOW	41	83
CAPE BLANCO	34	80
CAPE CARTHAGE	16	
CAPE DECISION, USA	47	
CAPE DOUGLAS,USA	13	
CAPE HUDSON	117	87
CAPE JUBY	13	11
CAPE MAY	51	
CARIBE 1	6	
CARINA,PANAMA	35	113
CARLA A. HILLS	42	121
CARMAN	51	
CARMEL	28	
CAROLINA	54	88
CARTAGENA	158	77
CASON J. CALLAWAY	152	165
CAVALLINO,PANAMA	48	26
CELEBRATION	52	55
CENTURY HIGHWAY NO. 5	156	
CENTURY HIGHWAY NO.2 P	159	
CGM ILE DE FRANCE	103	50
CGM LORRAINE	40	
CGM PROVENCE	39	
CHAITEN, LIBERIA	50	
CHARLES E. WILSON	19	38
CHARLES M. BEEGHLEY	199	208
CHARLESTON	37	21
CHARLOTTE LYKES	71	68
CHEMICAL PIONEER	97	61
CHERRY VALLEY	22	74
CHESAPEAKE TRADER	35	
CHESNUT HILL	34	1
CHEVRON ANTWERP,BAHAMA	109	
CHEVRON BURNABY	16	60
CHEVRON CALIFORNIA	137	57
CHEVRON COLORADO	42	159
CHEVRON COPENHAGEN	78	
CHEVRON EDINBURGH	46	96
CHEVRON HORIZON	159	
CHEVRON METEOR	52	36
CHEVRON MISSISSIPPI	95	102
CHEVRON NAGASAKI	92	
CHEVRON OREGON	10	27
CHEVRON PACIFIC	40	250
CHEVRON STAR	56	
CHEVRON SUN	1	99
CHEVRON WASHINGTON	42	49
CHICKASAW	74	45
CHINA GLORY	7	
CHINA PRIDE	31	
CHIQUITA BOCAS	30	
CHIQUITA CINCINNATION	86	
CHO YANG SUCCESS	1	
CLEMENTINA	45	
CLEVELAND	32	
CO-OP EXPRESS III	45	89
COASTAL EAGLE POINT	9	
COLIMA	18	134
COLUMBIA STAR	125	110
COLUMBINE	48	28
COLUMBUS AMERICA	368	
COLUMBUS AUSTRALIA	126	
COLUMBUS LOUISANA	68	
COLUMBUS NEW ZEALAND	102	
COLUMBUS OHIO	123	24
COLUMBUS OLIVOS	88	65
COLUMBUS QUEENSLAND	49	
COLUMBUS VICTORIA	214	
COLUMBUS VIRGINIA	150	
COLUMBUS WELLINGTON	120	
COMPANION EXPRESS	27	
CONCERT EXPRESS	103	
CONSENSUS SEA	9	
CONTIENTAL WING	96	
CONTINENTAL RELIANCE	7	
CONTINENTAL SPIRIT	21	
CONTSHIP AUSTRALIA	19	
CORAH ANN	62	59
CORNHUSKER STATE	8	27
CORNUCOPIA	3	76
CORONADO	21	
CORWITH CRAMER	20	
COURIER	19	
COURTNEY BURTON	111	125
CPL. LOUIS J. HAUGE JR	53	
CRISTOFORO COLOMBO	29	39
CSS HUDSON	78	
DAMIOS DE GOIS	79	
DAN MOORE	1	9
DELAWARE TRADER	24	27
DIAMOND STATE	1	4
DIANA	16	45
DIRECT KIWI	125	
DIRECT KOOKABURRA, NOR	54	271
DOCTOR LYKES	67	
DON JORGE	22	29
DONAIRE	129	
DSR OAKLAND	44	
DSR YOKOHAMA	104	
DUSSELDORF EXPRESS	96	
DYVI OCEANIC	24	
EASTERN GLORY	13	
ECSTASY	77	
EDGAR B. SPEER	213	229
EDWARD L. RYERSON	190	198
EDWIN H. GOTT	205	370
EDYTH L.	6	
ELIZABETH LYKES	44	61
ENDEAVOR	62	32
EQUALITY STATE	1	
ESPERANCE	55	
ESPERANZA	25	
ESSO PUERTO RICO	22	
ETERNITY	47	
EUROPEAN SENATOR	23	
EVER GAINING	7	
EVER GARDEN	11	
EVER GARLAND	5	
EVER GATHER	47	12
EVER GENTLE	9	
EVER GIANT	11	
EVER GIVEN	5	
EVER GLAMOUR	2	
EVER GLEEFUL	9	
EVER GLOBE,PANAMA	18	11
EVER GLOWING	2	

	RADIO	MAIL
EVER GOING	15	
EVER GRADE	38	13
EVER GRAND	4	
EVER GROUP	6	
EVER GROWTH	4	
EVER GUARD	13	
EVER GUEST	10	5
EVER LAUREL	23	12
EVER LEVEL	5	6
EVER LIVING	7	
EXPORT FREEDOM	20	82
EXPORT PATRIOT	66	19
EXXON BATON ROUGE	18	23
EXXON BENICIA	30	5
EXXON CHARLESTON	1	
EXXON LONG BEACH	10	
EXXON MEDITERRANEAN	30	24
EXXON NEW ORLEANS	12	12
EXXON PHILADELPHIA	46	34
EXXON SAN FRANCISCO	44	62
FAUST	47	51
FERNCROFT	63	74
FESTIVALE	9	
FETISH	87	82
FLEMMING SIF	50	18
FLICKERTAIL STATE	7	13
FLORIDA RAINBOW	63	92
FRANCES HAMMER	70	
FRANCES L.	75	39
FRED R. WHITE JR	11	47
GALVESTON BAY	41	77
GEMINI	39	115
GENEVIEVE LYKES	14	
GEORGE A. SLOAN	141	152
GEORGE A. STINSON	79	128
GEORGE H. WEYERHAEUSER	28	37
GEORGE WASHINGTON BRID	196	16
GEORGIA RAINBOW II	29	90
GERMAN SENATOR	70	
GLACIER BAY	44	72
GLOBAL LINK	22	39
GLOBAL SENTENIAL	38	
GOLDEN APO	25	24
GOLDEN GATE	12	29
GOLDEN GATE BRIDGE	185	54
GOLDEN HAWK	5	12
GOLDEN TOPAZ	9	
GREAT LAND	52	345
GREAT RIVER	22	118
GREEN BAY	54	38
GREEN HARBOUR	56	91
GREEN ISLAND	36	30
GREEN KOBE	22	97
GREEN LAKE	78	141
GREEN RIDGE	97	116
GREEN SAIKAI	5	92
GREEN SASEBO	15	74
GREEN SUMA	26	39
GREEN VALLEY	30	72
GREEN WAVE	25	111
GTS ADMIRAL WILLIAM MC	4	7
GUANAJUATO	95	75
GUAYAMA	30	65
GULF BANKER	43	
GULF SPEED	43	
GULF SPIRIT	137	
GYPSUM BARON	188	
GYPSUM KING	190	
GYRE	31	
HANEI SKY	20	98
HANJIN CHUNGMU	29	
HANJIN FELIXSTOWE	11	
HANJIN HAMBURG	11	
HANJIN HONG KONG	15	
HANJIN KAOHSIUNG	15	
HANJIN KEELUNG	25	
HANJIN KOBE	40	
HANJIN LE HAVRE	18	
HANJIN LONG BEACH	14	
HANJIN MASAN	39	45
HANJIN NEW YORK	18	
HANJIN OAKLAND	14	
HANJIN POHANG	28	10
HANJIN SAVANNAH	34	
HANJIN SEATTLE	10	
HANJIN SEOUL	35	9
HANJIN TONGHAE	42	2
HANJIN VANCOUVER	5	
HANJIN YOKOHAMA	37	
HANNOVERLAND	83	
HANSA LUBECK	64	
HANSA VISBY	46	
HAWAIIAN RAINBOW	41	107
HEIDELBERG EXPRESS	28	
HENRY HUDSON BRIDGE	189	
HERBERT C. JACKSON	8	
HERMENIA	66	43
HESIOD	8	
HIRA II	17	
HOEGH CAIRN	2	32
HOEGH CLIPPER	28	14
HOEGH DRAKE	8	
HOEGH DUKE	15	
HOEGH DYKE	28	22
HOEGH MIRANDA	26	
HOLCK LARSEN,INDIA	12	
HOLIDAY	47	
HONOLULU	1	
HORNSTREAM	7	15
HOWELL LYKES	37	57
HUAL LISITA	14	32
HUAL TRAPPER,PANAMA	13	19
HUMACAO	31	20
HYUNDAI #203	9	
HYUNDAI CHALLENGER	21	
HYUNDAI COMMANDER	32	
HYUNDAI CONTINENTAL	51	
HYUNDAI EXPLORER	19	
HYUNDAI INNOVATOR	10	
HYUNDAI NO 102	13	
HYUNDAI PIONEER	23	
INDEPENDENT SPIRIT	106	
INDIAN OCEAN	45	51
INFANTA	85	
INGER	26	46
ISLAND PRINCESS	67	
ITB NEW YORK	134	182
ITB PHILADELPHIA	43	29
IVER EXPLORER	104	
IVER EXPRESS	115	
J.DENNIS BONNEY,MONRAV	30	
J.L. MAUTHE	142	150
JACKSONVILLE	93	118
JALISCO	53	75
JAMES LYKES	36	
JAMES R. BARKER	153	286
JAPAN RAINBOW 2	67	25
JAPAN SENATOR	62	
JO BIRK	64	
JO BRIED	13	20
JO LONN	108	
JO OAK	1	
JO ROGN	74	
JOANN M	59	
JOHN G. MUNSON	186	132
JOHN J BOLAND,USA	108	151
JOHN LYKES	24	118
JOHN V. VICKERS	1	
JOHN YOUNG	140	
JOSEPH H. FRANTZ	261	295
JOSEPH L. BLOCK	59	93
JULIUS HAMMER	58	
KAIMOKU	51	127
KAINULA	79	198
KAUAI	53	143
KAYE E. BARKER	116	150
KEISHO MARU	38	
KENAI	31	107
KENNETH E. HILL	15	64
KENNETH T. DERR	68	164
KENTUCKY HIGHWAY	11	
KEYSTONE CANYON	125	153
KEYSTONER	29	97
KOKUA	138	216
KOLN ATLANTIC	83	
KOPER EXPRESS	16	
KOYAGI SPIRIT	5	
KRAS	20	16
KUROBE	31	
LA TRINITY	18	
LAKE GUARDIAN	84	51
LASH ATLANTICO	6	22
LAUST MAERSK	49	121
LAWRENCE H. GIANELLA	31	
LEONARD J. COWLEY	21	
LERMA	173	
LESLIE LYKES	6	74
LETITIA LYKES	56	41
LIBERTY BELLE,USA	4	19
LIBERTY SEA	1	
LIBERTY SPIRIT	13	
LIBERTY STAR	71	29
LIBERTY SUN	82	137
LIBERTY WAVE	22	
LIRCAY	61	
LNG AQUARIUS	57	47
LNG LEO	64	145
LNG TAURUS	1	143
LNG VIRGO	47	131
LOTUS ACE	5	
LOUIS MAERSK	43	58
LOUISE LYKES	30	
LURLINE	45	140
LYRA	54	
M.V.CARRIBEAN EMERALD,	19	142
M/S VIVA	65	85
M/T ELLEN KNUTSEN,NORW	41	22
M/V HUAL INGRITA,NORWA	6	18
MAASSLOT	99	
MAASSTROOM	144	
MACKINAC BRIDGE	216	69
MADISON MAERSK	36	110
MAERSK COMMANDER	124	
MAERSK CONSTELLATION	92	92
MAERSK SUN	80	118
MAERSK WIND	88	184
MAGIC	42	
MAGLEBY MAERSK	48	76
MAJ STEPHEN W PLESS MP	24	29
MAJESTIC MAERSK	27	96
MANHATTAN BRIDGE	138	
MANUKAI	45	192
MANULANI	57	176
MANYAS-1	50	55
MARATHA MAJESTY	16	
MARCHEN MAERSK	27	
MAREN MAERSK	7	16
MARGARET LYKES	24	71
MARGRETHE MAERSK	46	50
MARIA TOPIC	3	
MARIE MAERSK	39	104
MARIF	43	48
MARINE RELIANCE	20	9
MARIT MAERSK	50	25
MARJORIE LYKES	57	114
MARLIN	156	
MASON LYKES	27	
MATHILDE MAERSK	7	100
MATSONIA	39	198
MAUI	50	69
MAURICE EWING	130	131
MAYAGUEZ	34	72
MAYVIEW MAERSK	26	50
MC-KINNEY MAERSK	34	108
MEDALLION	145	65
MEDUSA CHALLENGER	290	334
MELBOURNE HIGHWAY	39	
MELBOURNE STAR	105	
MELVILLE	3	
MEONIA	159	
MERCANDIAN CONTINENT	44	18
MERCANDIAN SUN II	42	
MERCHANT PRELUDE	11	39
MERCURY ACE	29	
MERIDA	18	
MERKUR PORTUGAL	31	
MESABI MINER	64	109
METTE MAERSK	26	98
MICHIGAN HIGHWAY	20	
MICHIGAN,USA	179	301
MICRONESIAN COMMERCE	28	38
MICRONESIAN INDEPENDEN	70	
MIDDLETOWN	34	43
MING AUTUMN	8	
MING COMFORT	26	
MING OCEAN	23	24
MING PLEASURE	12	
MING PLENTY	15	25
MING SUN	7	
MING UNIVERSE	19	
MITLA	52	47
MOANA PACIFIC	59	
MOANA WAVE	70	207

	RADIO	MAIL
MOKU PAHU	102	136
MONTE CERVANTES	21	
MONTERREY	92	114
MORELOS	52	32
MORMACSKY	53	95
MORMACSTAR	35	92
MORMACSUN	39	11
MV GEMINI,USA	9	34
MV/TORM FREYA,DENMARK	115	147
MYRON C. TAYLOR	224	238
NACIONAL VITORIA	47	
NAPIER STAR	32	
NARA	74	56
NATIONAL DIGNITY	28	85
NATIONAL HONOR	23	85
NATIONAL PRIDE	32	69
NCC ARAR	12	
NECHES	1	
NEDLLOYD CLARENCE	3	
NEDLLOYD HOLLAND	51	113
NEDLLOYD HONG KONG	98	
NEDLLOYD HUDSON	54	24
NEDLLOYD MADRAS	144	
NEDLLOYD MANILA	118	
NEDLLOYD ROTTERDAM	124	
NEDLLOYD ROUEN	154	
NEDLLOYD VAN CLOON	109	
NEDLLOYD VAN DIEMEN	85	
NEDLLOYD VAN NOORT	127	
NEPTUNE ACE	19	
NEPTUNE AGATE	34	
NEPTUNE AMBER	52	
NEPTUNE CORAL	43	
NEPTUNE CRYSTAL	58	
NEPTUNE DIAMOND	134	
NEPTUNE GARNET	40	
NEPTUNE JADE	32	
NEPTUNE PEARL	15	
NEW HORIZON	101	131
NEW YORK SENATOR	52	
NEWARK BAY	69	115
NIEUW AMSTERDAM	49	
NIPPON HIGHWAY	18	
NOAA DAVID STARR JORDA	125	220
NOAA SHIP ALBATROSS IV	238	244
NOAA SHIP CHAPMAN	295	120
NOAA SHIP DELAWARE II	192	163
NOAA SHIP DISCOVERER O	244	255
NOAA SHIP FERREL	9	
NOAA SHIP M. BALDRIDGE	488	
NOAA SHIP MCARTHUR	83	90
NOAA SHIP MILLER FREEM	382	410
NOAA SHIP MT MITCHELL	172	303
NOAA SHIP OREGON II	400	480
NOAA SHIP RAINIER	195	63
NOAA SHIP SURVEYOR	42	112
NOAA SHIP T. CROMWELL	130	490
NOAA SHIP WHITING	479	495
NOBLE ACE	17	
NOMADIC LADY	15	
NOSAC EXPLORER	21	17
NOSAC EXPRESS	21	46
NOSAC RANGER	47	80
NOSAC TAKAYAMA	62	40
NUEVO SAN JUAN	31	
NURNBERG ATLANTIC	87	
NYK STARLIGHT	75	
OAXACA	67	78
OBO ENGIN	52	11
OCEAN ASPIRATION	90	199
OCEAN CHEER	54	
OCEAN CONQUEROR	32	126
OCEAN GOLD,KOREA	14	
OCEAN HIGHWAY	22	
OCEAN ISLAND	15	
OCEAN LILY	20	
OCEAN SEL	10	
OCEAN SPIRIT	44	
OCEAN VICTOR	5	56
OLEANDER	141	128
OLGA TOPIC	3	12
OLIVE ACE	83	
OMI CHARGER	54	52
OMI MISSOURI	81	97
OMI WABASH	59	43
OOCL BRAVERY	72	
OOCL EDUCATOR	57	
OOCL ENVOY	65	72
OOCL EXECUTIVE	48	
OOCL EXPLORER	94	134
OOCL EXPORTER	71	
OOCL FAIR	106	79
OOCL FAITH	75	
OOCL FORTUNE	110	121
OOCL FREEDOM	194	
OOCL FRIENDSHIP	23	
ORANGE BLOSSOM	37	21
ORANGE STAR	92	92
ORCHID	41	108
OREGON RAINBOW II	43	163
ORION HIGHWAY	40	38
OVERSEAS BOSTON	36	40
OVERSEAS CHICAGO	8	21
OVERSEAS HARRIET	12	
OVERSEAS JOYCE	48	127
OVERSEAS JUNEAU	118	
OVERSEAS MARILYN	35	55
OVERSEAS NEW ORLEANS	22	53
OVERSEAS NEW YORK	33	73
OVERSEAS OHIO	42	
PACASIA	18	
PACBARON	38	
PACDUCHESS	48	
PACDUKE	36	29
PACGLORY	12	
PACIFIC EMERALD	82	199
PACIFIC PRINCESS	122	
PACIFIC SONG	15	
PACKING	84	18
PACMERCHANT	65	
PACNOBLE	5	
PACOCEAN	25	22
PACPRINCE	4	
PACPRINCESS	76	
PACQUEEN	30	
PACSEA	16	
PACSTAR	26	
PACSUN	26	
PACTRADER	8	2
PAPAGO	103	71
PAPYRUS	67	
PARIS SENATOR	32	
PATRIOT	33	
PAUL BUCK	25	13
PAUL H. TOWNSEND	93	139
PAUL R. TREGURTHA	199	338
PECAN,MANILA	100	
PECOS	22	
PEGGY DOW	119	
PELANDER	20	34
PERMEKE	15	
PETROBULK PROGRESS	80	116
PFC EUGENE A. OBREGON	13	36
PFC JAMES ANDERSON JR	2	
PFC WILLIAM B. BAUGH	15	
PHAROS	71	
PHILIP R. CLARKE	152	164
PINE FOREST	19	
POLAR ALASKA	23	64
POLYDEFKIS_P.	66	79
POLYNESIA	252	93
POMEROL	26	41
POTOMAC TRADER	6	
PRESIDENT ADAMS	144	175
PRESIDENT ARTHUR	19	87
PRESIDENT BUCHANAN	33	60
PRESIDENT EISENHOWER	187	137
PRESIDENT F. ROOSEVELT	60	160
PRESIDENT GRANT	24	110
PRESIDENT HARDING	82	66
PRESIDENT HARRISON	1	
PRESIDENT HOOVER	28	116
PRESIDENT JACKSON	157	141
PRESIDENT JEFFERSON	38	133
PRESIDENT JOHNSON	11	33
PRESIDENT KENNEDY	100	157
PRESIDENT LINCOLN	150	191
PRESIDENT MADISON	108	172
PRESIDENT MONROE	145	218
PRESIDENT PIERCE	36	53
PRESIDENT POLK	155	166
PRESIDENT TRUMAN	119	88
PRESIDENT TYLER	52	160
PRESIDENT WASHINGTON	203	160
PRESQUE ISLE	159	314
PRINCE OF OCEAN	87	101
PRINCE OF TOKYO	121	159
PRINCE OF TOKYO 2	90	195
PRINCE WILLIAM SOUND	57	35
PRINSENGRACHT	78	
PROOF GALLANT,LIBERIA	33	
PROSPERO	40	61
PURITAN	3	
PVT FRANKLIN J. PHILLI	11	17
QUALITY OF LIFE	49	
QUEEN ELIZABETH 2	149	
QUEENSLAND STAR	172	
RAINBOW BRIDGE	175	
RAINBOW HOPE	142	180
RALEIGH BAY	61	173
RANA M	15	
RANGER	79	
RANGER III,USA	38	45
RANI PADMINI	23	
RECIFE	107	
REFORM	18	
RESERVE	15	13
RESOLUTE	55	119
RICHARD G MATTIESEN	39	
RICHARD REISS	1	
RICHARD REISS,USA	23	114
RIO FRIO	116	
RIO NEGRO II	5	
RIVERHEAD SPIRIT, USA	7	
ROBERT E. LEE	11	31
ROGER BLOUGH	71	229
ROSEBANK	122	
ROSETTA	54	53
ROSINA TOPIC	11	148
ROTTERDAM	51	
ROVER	59	177
ROWANBANK	2	
ROYAL PRINCESS	127	
RUBIN DOGA	45	
RUBIN OCEAN	66	80
RUBIN STEIN	32	24
RUTH LYKES	51	55
S.T. CRAPO	41	76
S.T.SEAL ISLAND,LIBERI	1	
S/S DAVID PACKARD,BAHA	17	
SALINA CRUZ	193	62
SALINAS	44	137
SAM HOUSTON	20	24
SAMU	1	
SAMUEL H ARMACOST,BAHA	33	
SAMUEL L. COBB	36	28
SAN MARTIN	40	
SAN NICOLAS	6	
SAN PEDRO	67	
SANKO PIONEER	40	
SANKO PRELUDE	23	120
SANSINENA II	64	39
SANTA BARBARA	32	
SANTA MONICA	11	
SANTOS	51	
SAPAI	10	
SATURN DIAMOND	32	
SAVANNAH	104	
SCAN	14	
SCARAB	79	39
SEA BELLS	26	224
SEA COMMERCE	63	
SEA FAN	59	85
SEA FORTUNE	39	140
SEA FOX	19	31
SEA LIGHT	29	34
SEA LION	54	
SEA MERCHANT	406	120
SEA TRADE	8	
SEA WOLF	173	27
SEALAND ACHIEVER	187	266
SEALAND ANCHORAGE	57	148
SEALAND ATLANTIC	48	68
SEALAND CHALLENGER	88	105
SEALAND CONSUMER	107	119
SEALAND CRUSADER	114	40
SEALAND DEFENDER	162	120
SEALAND DISCOVERY	54	44
SEALAND ENDURANCE	47	27
SEALAND ENTERPRISE	208	220
SEALAND EXPEDITION	12	30
SEALAND EXPLORER	71	113
SEALAND EXPRESS	71	154

	RADIO	MAIL
SEALAND HAWAII	122	252
SEALAND INNOVATOR	69	118
SEALAND INTEGRITY	61	58
SEALAND KODIAK	52	82
SEALAND LIBERATOR	69	109
SEALAND MARINER	50	91
SEALAND NAVIGATOR	193	218
SEALAND PACIFIC	205	223
SEALAND PATRIOT	74	132
SEALAND PERFORMANCE	70	81
SEALAND PRODUCER	75	214
SEALAND QUALITY	50	91
SEALAND RELIANCE	88	211
SEALAND SPIRIT	55	232
SEALAND TACOMA	43	24
SEALAND TRADER	204	221
SEALAND VALUE	74	137
SEALAND VOYAGER	89	32
SEAWARD BAY	17	
SEDCO/BP 471	298	184
SEMINOLE	128	123
SENATOR	17	
SGT WILLIAM A BUTTON	25	
SGT. METEJ KOCAK	15	
SHELDON LYKES	61	30
SHELLY BAY	31	
SHENAHON	38	50
SHIRAOI MARU	96	56
SHOSHONE SPIRIT	18	
SIERRA MADRE	33	115
SITHEA	2	59
SKANDERBORG	60	27
SKAUBRYN	153	
SKAUGRAN	139	98
SKODSBORG	25	32
SOLAR WING	83	179
SONBAI	1	
SONORA	62	
SOUND CRUZ,MEXICO	43	
SOUTHLAND STAR	157	
SPRING BEAR	165	
ST. CLAIR	113	205
STAR EAGLE	74	57
STAR EVVIVA	22	
STAR FLORIDA	25	
STAR FRASER	96	
STAR GEIRANGER	9	
STAR GRAN	129	
STAR GRINDANGER	23	17
STAR HONG KONG	105	
STAR LIVORNO	154	
STAR MERCHANT	1	39
STAR OREGON	42	28
STAR WILMINGTON	80	
STATE OF MAINE	12	40
STELLA LYKES	13	72
STEWART J. CORT	261	446
STONEWALL JACKSON	16	36
STRIDER ISIS	134	127
STUTTGART EXPRESS	384	
SUE LYKES	11	
SUGAR ISLANDER	13	58
SUNBELT DIXIE	77	
SUNRISE RUBY	8	29
SWIFTNES	42	
T.S.EMPIRE STATE	75	
TABASCO	68	
TAI CHUNG	37	57
TAI HE	153	
TAI SHAN	28	
TAI SHING	32	
TAMPA	11	
TAMPA BAY	66	47
TARKWA,NORWAY	42	69
TEXACO WESTCHESTER	16	
TEXAS CLIPPER	29	
TEXAS TRADER	34	37
THOMAS WASHINGTON	23	56
TILLIE LYKES	47	74
TOLUCA	84	90
TONCI TOPIC	16	54
TONSINA	52	34
TOWER BRIDGE	63	
TRANSWORLD BRIDGE	125	79
TRITON	110	281
TROPICAL BEAUTY	12	
TROPICALE	50	
TSL BRAVO	108	110
TYSON LYKES	44	88
UCHOA	192	233
ULTRAMAR	39	84
ULTRASEA	28	98
UNAMONTE	5	
UNIVERSE	31	
USCGC ACACIA (WLB406)	1	3
USCGC ACTIVE WMEC 618	35	
USCGC ACUSHNET WMEC 16	1	
USCGC ALERT (WMEC 630)	8	
USCGC BEAR (WEMC 901)	18	
USCGC BRAMBLE (WLB 392	6	
USCGC CAMPBELL	37	
USCGC CHASE (WHEC 718)	2	
USCGC CITRUS (WMEC 300	26	
USCGC CONFIDENCE WMEC6	6	
USCGC COURAGEOUS	25	
USCGC DEPENDABLE	9	
USCGC DURABLE (WMEC 62	16	
USCGC EAGLE (WIX 327)	78	
USCGC ESCAPE (WMEC 6)	60	30
USCGC FIREBUSH WLB 393	15	
USCGC FORWARD	64	22
USCGC GALVESTON ISLAND	58	
USCGC HAMILTON WHEC 71	24	170
USCGC IRONWOOD (WLB 29	56	57
USCGC JARVIS (WHEC 725	35	
USCGC KATMAI BAY	1	
USCGC LAUREL (WLB 291)	5	
USCGC MACKINAW	24	35
USCGC MALLOW (WLB 396)	12	
USCGC MELLON (WHEC 717	118	71
USCGC MOHAWK WMEC 913	59	
USCGC MUNRO	112	
USCGC NEAH BAY	3	
USCGC NORTHLAND WMEC 9	19	11
USCGC PLANETREE	18	
USCGC POLAR SEA__(WAGB	228	92
USCGC RELIANCE WMEC 61	52	51
USCGC RUSH	148	
USCGC SEDGE (WLB 402)	19	
USCGC SENECA	2	7
USCGC SPENCER	14	6
USCGC STEADFAST WMEC 6	9	
USCGC STORIS (WMEC 38)	24	26
USCGC SUNDEW (WLB 404)	41	117
USCGC SWEETBRIER WLB 4	54	
USCGC TAHOMA	32	
USCGC TAMAROA (WMEC 16	79	
USCGC TAMPA WMEC 902	64	42
USCGC VENTUROUS WMEC 6	17	
USCGC VIGILANT WMEC 61	6	
USCGC YOCONA (WMEC 168	200	
USNS ALTAIR	1	
USNS ASSURANCE AGOS-5		48
USNS BARTLETT(T-AGOR 1	79	
USNS BOLD	1	
USNS CHAUVENET TAGS 29	81	
USNS DE STEIGUER	39	
USNS GUS W. DARNELL	87	
USNS JOHN LENTHALL	37	
USNS JOHN MCDONNELL (T	51	36
USNS LITTLEHALES (T-AG	6	114
USNS MERCURY	106	83
USNS MOHAWK (T-ATF 170	23	
USNS NARRAGANSETT	90	
USNS NAVAJO_(TATF-169)	44	
USNS POTOMAC	11	
USNS POWHATAN TATF 166	12	13
USNS REDSTONE	66	
USNS SATURN T-AFS-10	35	
USNS SEALIFT ARCTIC	78	
USNS SEALIFT CARIBBEAN	60	42
USNS SEALIFT CHINA SEA	6	
USNS SEALIFT MEDITERRA	34	
USNS SILAS BENT T-AGS	91	
USNS VANGUARD TAG 194	72	
USNS VICTORIOUS	38	
USNS WILKES T-AGS-33	87	
VALIANT	3	
VERA ACORDE	13	86
VIKING ACE	32	7
VINE	196	
WALTER J. MCCARTHY	100	209
WASHINGTON HIGHWAY	59	
WASHINGTON RAINBOW #2	47	195
WECOMA	88	107
WELLINGTON STAR	189	
WESTERN FUTURE	7	
WESTWARD	32	
WESTWARD VENTURE	18	82
WESTWOOD ANETTE	81	83
WESTWOOD BELINDA	13	10
WESTWOOD CLEO	98	101
WESTWOOD JAGO	92	
WESTWOOD MARIANNE	39	118
WHITING SEA	54	
WILFRED SYKES	147	135
WILLIAM E. MUSSMAN	13	64
WILLIAM R. ROESCH	30	97
WOLVERINE	36	39
WORLD WING #2	58	
YANKEE CLIPPER	86	
YOUNG SPROUT, PORT VIL	40	33
ZETLAND	269	
ZEUS	3	
ZIM AMERICA	49	
ZIM CALIFORNIA	38	
ZIM CANADA	57	
ZIM HOUSTON	8	
ZIM IBERIA	43	
ZIM KEELUNG	73	
ZIM KINGSTON III	334	
ZIM MARSEILLES	15	
ZIM MIAMI	74	
ZIM SAVANNAH	55	
ZOELLA LYKES	16	

SUMMARY: GRAND TOTAL VIA RADIO 56664

GRAND TOTAL VIA MAIL 48465

TOTAL UNIQUE OBS 82023

TOTAL DUPLICATES 23106 (28.2%)

UNIQUE RADIO OBS.33558 (40.9%)

UNIQUE MAIL OBS. 25359 (30.9%)

Bathy-Tesac Data at NMC

April, May, and June 1992

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME	CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
A8VI	35	35	0	PACDUCHESS	JDRD	1	1	0	SHOYO MARU
BOAB	92	92	0	TAI HE	JDWX	73	73	0	KOFU MARU
CGDG	128	0	128	HUDSON	JFDG	79	79	0	SHUMPU MARU
CG2683	36	36	0	ALFRED NEEDLER	JFPQ	26	26	0	KASHIMASAN MARU
CG2965	2	2	0	RICKER	JGZK	102	102	0	RYOFU MARU
CTFK	4	4	0	***	JITV	130	130	0	WELLINGTON MARU
CYWK	72	0	72	ENDEAVOR	JKCF	39	39	0	***
C6HL8	51	51	0	COLUMBIA STAR	JNZL	2	2	0	KAIYO MARU
C6IO	40	40	0	***	JPVB	50	50	0	SEIFU MARU
C6JY6	148	148	0	MELBOURNE STAR	JSVY	9	9	0	SHIRASE
C6JZ2	145	145	0	AMERICAN STAR	J8FO	101	101	0	ROSEBANK
DAKE	73	73	0	KOELN ATLANTIC	KGJB	24	24	0	SEALAND DEFENDER
DA9100	184	184	0	PLATFORM NORDSEE	KGWU	3	3	0	TH. WASHINGTON
DD8436	104	104	0	***	KIRH	94	94	0	SEALAND TRADER
DGLM	70	70	0	MONTE ROSA	KJCL	2	0	2	GYRE
DGVK	68	68	0	COLUMBUS VICTORIA	KNFG	45	45	0	SEA WOLF
DGZV	40	40	0	COLUMBUS VIRGINIA	KRGB	143	143	0	SEALAND ENTERPRISE
DHCW	52	52	0	COLUMBUS WELLINGTON	KVWA	8	8	0	TEXAS CLIPPER
DHOU	2	2	0	PURITAN	LADB2	63	63	0	SKAUGRAN
DIDA	53	53	0	ARIANA	LAJV4	70	70	0	SKAUBRYN
DLEZ	52	52	0	YANKEE CLIPPER	LJIT	1	0	1	HAKON MOSBY
D5BC	27	27	0	SEDCO/BP471	LLZG	54	0	54	***
D5NE	29	29	0	MT CABRITE	LNIW	2	0	2	***
D5NZ	205	205	0	POLYNESIA	LRAQ	17	17	0	EDUARDO L. HOLMBERG
EFEL	2	2	0	***	MKUE3	1	1	0	***
ELBX3	66	66	0	PACKING	NAVOC	10	10	0	U.S. NAVAL OCEANOGRAPHIC
ELED8	47	47	0	PACPRINCESS	NAVOCE	139	139	0	U.S. NAVAL OCEANOGRAPHIC
ELEH4	16	16	0	C R POINTE NOIRE	NDJC	2	2	0	CALLAGHAN
ELHL6	95	95	0	COLUMBUS OHIO	NDWA	2	2	0	MORGENTHAU
ELIL9	98	98	0	NAVIGATOR	NGDF	13	13	0	MUNRO
ELIS	143	143	0	MARINER	NHTM	6	6	0	***
EREC	122	11	111	PRILIV	NICB	10	10	0	***
ERET	32	25	7	GEORGE OUSHAKOV	NIDK	73	73	0	ICEPAT GROTON CT
FAQV	4	4	0	BALNY	NJVF	1	1	0	***
FITA	96	96	0	NOROIT	NLPM	1	1	0	CHASE
FNCZ	94	94	0	DELMAS SURCOUF	NMEL	34	34	0	MELLON
FNGS	122	122	0	LA FAYETTE	NRCD	1	1	0	***
FNIB	1	1	0	THALASSA	NRUO	123	123	0	POLAR SEA
FNQB	98	98	0	ILE MAURICE	NSBR	1	1	0	SAMUEL ROBERTS
FNQM	56	56	0	SUZANNE DELMAS	NTRI	31	31	0	WILKES
FNXW	5	5	0	SAINT ROCH	NZSK	17	17	0	E.KANE
FNZB	22	22	0	SAINT ROLAND	OWUO6	24	24	0	MOANA PACIFIC
FNZO	63	63	0	RABELAIS	PGDI	83	83	0	NEDLLOYD MANILA
FNZP	109	109	0	RACINE	PGDY	65	65	0	NEDLLOYD MADRAS
FNZQ	108	108	0	RIMBAUD	PGEC	47	47	0	NEDLLOYD VAN NOORT
FPYO	7	7	0	CAP SAINT PAUL	PGFE	52	52	0	NEDLLOYD VAN DIEMEN
FWQP	2	2	0	A. NIZERY	PJJU	83	83	0	OLEANDER
GAANG	27	27	0	***	RV0	26	26	0	***
GACA	135	135	0	CUMULUS	SBXF	1	1	0	***
GDLS	5	5	0	DARWIN	SCOU	2	2	0	TV 243
GYRW	106	106	0	ENCOUNTER BAY	SCPI	1	1	0	TV 258
GYSA	14	14	0	FLINDERS BAY	SCPK	1	1	0	TV 260
GYSE	63	63	0	NEDLLOYD TASMAN	SCPL	1	1	0	***
HPAN	31	31	0	MICRONESIAN COM-	SEPI	18	0	18	ARGOS
MERCE					SEXN	9	9	0	TV 227
HPEW	151	151	0	PACIFIC ISLANDER	SEXQ	6	6	0	TV 278
H9BQ	29	29	0	MICRONESIAN INDE-	SEYD	5	5	0	TV 274
PENDENCE					SHIP	725	723	2	***
JBOA	77	77	0	KEIFU MARU	SHPF	2	2	0	TV 281
JCCX	68	68	0	CHOFU MARU	SJIB	1	1	0	TV 282
JCDF	105	105	0	SOYO MARU	SKVP	9	9	0	TV 284

Bathy–Tesac Data at NMC

April, May, and June 1992

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
SLDN	1	1	0	TV 10
SMZQ	4	4	0	TV102
S6FK	143	143	0	SWAN REEFER
TFEA	48	48	0	BJARNI SAEMUNDSSON
TWR3	3	3	0	***
UBNZ	22	18	4	SHULEYKIN AKADEMIK
UINF	2	2	0	VLADIMIR PARSHIN
UVMJ	6	2	4	VSEVOLOD BERYOZKIN
UVMM	5	5	0	GAKKEL, YAKOV
VC9616	23	23	0	LADY HAMMOND
VJBQ	50	50	0	ANRO AUSTRALIA
VJDI	120	120	0	IRON NEWCASTLE
VJDP	124	124	0	IRON PACIFIC
VKCN	234	234	0	CANBERRA
VKCV	69	69	0	DERWENT
VKLA	67	67	0	ADELAIDE
VKLB	150	150	0	HOBART
VKLC	15	15	0	BRISBANE
VKLP	9	9	0	***
VKMS	7	7	0	COOK
VKPT	53	53	0	PERTH
VLNB	40	40	0	TORRENS
WCGN	40	40	0	CHEVRON CALIFORNIA
WLDZ	12	12	0	MAURICE EWING
WPGK	61	61	0	SEALAND NAVIGATOR
WPKD	99	99	0	SEALAND ACHIEVER
WRBA	3	3	0	PACMISRANFAC HAWAREA
WRBB	3	3	0	***
WSRL	74	74	0	SEALAND PACIFIC
WTDF	2	2	0	TOWNSEND CROMWELL
WTDK	13	13	0	D.S. JORDAN
WTDM	18	1	17	MILLER FREEMAN
WTDO	98	76	22	OREGON II
WTED	5	5	0	CHAPMAN
WTEG	20	20	0	MOUNT MITCHELL
WTER	71	17	54	MALCOLM BALDRIGE
WTES	3	3	0	SURVEYOR
WTEW	56	55	1	WHITING
WUS9293	28	28	0	MOANA WAVE
WXBR	40	40	0	CHEVRON MISSISSIPPI
YDLR	62	62	0	BOGASARI LIMA
Y3CH	16	0	16	PROF. ALBRECHT PENCK
ZCAQ9	156	156	0	WESTMOOR
ZCKP	8	8	0	STAR HONG KONG
ZDAZ	56	56	0	EXPLORER
ZDBE9	59	59	0	VOYAGER
3EAW7	8	8	0	ANDINO
3EET4	23	23	0	SEAS EIFFEL
3EKW	64	64	0	UTRILLO
3EKW9	13	13	0	UTRILLO
7KDD	40	40	0	YOKO MARU
9VBZ	1	1	0	MAHSURI
9VUU	29	29	0	ANRO ASIA
9VVB	67	67	0	GOLDENSARI INDAH
9VWM	44	44	0	MANDAMA
21002	612	612	0	BUOY
21004	713	713	0	BUOY
21410	1	1	0	BUOY
22001	715	715	0	BUOY
32315	96	96	0	BUOY
32316	14	14	0	BUOY
32317	17	17	0	BUOY
32318	17	17	0	BUOY
32319	111	111	0	BUOY
43001	16	16	0	BUOY
51006	17	17	0	BUOY
51007	30	30	0	BUOY
51008	5	5	0	BUOY
51009	16	16	0	BUOY
51010	33	33	0	BUOY
51011	5	5	0	BUOY
51014	7	7	0	BUOY
51015	13	13	0	BUOY
51016	18	18	0	BUOY
51017	11	11	0	BUOY
51018	18	18	0	BUOY
51019	5	5	0	BUOY
51020	8	8	0	BUOY
51021	7	7	0	BUOY
51022	21	21	0	BUOY
51023	8	8	0	BUOY
51302	16	16	0	BUOY
51303	10	10	0	BUOY
51306	23	23	0	BUOY
52001	20	20	0	BUOY
52002	6	6	0	BUOY
52003	16	16	0	BUOY
52004	15	15	0	BUOY
52006	11	11	0	BUOY
52008	7	7	0	BUOY
52010	78	78	0	BUOY
52011	11	11	0	BUOY
52012	7	7	0	BUOY
52015	1	1	0	BUOY
52017	1	1	0	BUOY
52301	4	4	0	BUOY
52302	5	5	0	BUOY
52303	30	30	0	BUOY
52304	19	19	0	BUOY
52305	25	25	0	BUOY
52306	23	23	0	BUOY
52307	22	22	0	BUOY

TOTAL BATHYS RECEIVED 11551
TOTAL TESACS RECEIVED 515
TOTAL REPORTS RECEIVED 12066

April, May, and June 1992

Wave observations are taken each hour during a 20–minute averaging period, with a sample taken every 0.67 seconds. The significant wave height is defined as the average height of the highest one–third of the waves during the average period each hour. The maximum significant wave height is the highest of those values for that month. At most stations, air temperature, water temperature, wind speed and direction are sampled once per second during an 8.0–minute averaging period each hour (moored buoys) and a 2.0–minute averaging period for fixed stations (C–MAN). Contact NDBC Data Systems Division, Bldg 1100, SSC, Mississippi 39529 or phone (601) 688–2838 for more details.

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
APRIL	1992												
32302	18.0S	085.1W	0713	22.0	22.8	2.2	3.6	25/17	13.9	SE	22.2	24/16	1015.1
41001	34.9N	073.0W	0720	16.7	19.3	2.0	5.7	29/15	13.8	SE	31.5	05/19	1016.1
41002	32.3N	075.2W	0048	17.6	22.8	4.3	7.1	29/08	22.6	N	37.3	29/07	1010.6
41006	29.3N	077.4W	0718	20.8	22.7	1.9	7.2	14/04	13.1	E	32.3	14/02	1016.6
41008	30.7N	081.1W	0374	16.2	16.6	1.0	2.8	13/19	8.7	NE	24.3	13/17	1017.9
41009	28.5N	080.2W	1439	21.4	23.0	1.4	4.9	14/11	12.0	SE	23.9	14/03	1017.1
41010	28.9N	078.5W	1433	21.5	23.7	1.7	5.9	14/06	13.4	SE	29.5	14/03	1016.9
42001	25.9N	089.7W	0239	20.8	21.8	0.9	2.2	06/15	10.1	NE	23.5	10/22	1014.5
42002	25.9N	093.6W	0714	22.5	23.5	1.0	2.5	03/02	12.1	SE	29.1	06/07	1015.2
42003	25.9N	085.9W	0719	23.0	26.1	1.1	3.6	07/03					1016.2
42019	27.9N	095.0W	0719	21.0	21.9	1.0	3.1	29/17	10.1	SE	26.[illegible]	18/07	1014.9
42020	27.0N	096.5W	0720	21.9	22.4	1.1	3.4	29/12	11.0	SE	29.[illegible]	20/07	1014.3
42025	24.9N	080.4W	0672		24.9	0.7	2.0	17/06					
44004	38.5N	070.7W	0719	11.0	13.4	1.7	4.9	03/12	13.0	N	32.3	03/12	1015.9
44005	42.6N	068.6W	0701	3.5	3.4	1.3	3.6	03/19	12.5	N	29.3	03/15	1016.8
44007	43.5N	070.1W	0719	4.1	3.9	0.8	2.6	12/08	12.2	S	27.0	03/14	1015.3
44008	40.5N	069.4W	0719	5.7	5.5	1.4	3.5	03/19	13.6	N	33.4	03/20	1015.2
44009	38.5N	074.7W	0718	8.5	7.6	1.0	2.4	13/12	12.5	S	28.6	03/07	1016.5
44011	41.1N	066.6W	0718	3.5	2.6	1.7	4.6	03/23	11.1	NW	25.8	06/10	1015.6
44012	38.8N	074.6W	0719	7.9	7.1	0.9	2.2	13/11	12.3	S	29.1	03/10	1016.2
44013	42.4N	070.8W	0719	5.8	4.7	0.7	2.8	25/19	12.2	NW	29.1	03/15	1015.7
44014	36.6N	074.8W	0719	9.9	8.5	1.4	4.3	29/13	10.5	S	26.4	02/05	1016.3
44025	40.3N	073.2W	0693	6.7	5.7	0.8	2.0	11/19	10.4	S	24.5	03/04	1016.4
45001	48.1N	087.8W	0547	0.9	1.3	0.8	3.6	21/16	11.7	NE	31.7	12/03	1017.6
45002	45.3N	086.4W	0720	2.5	2.6	0.7	2.7	06/22	11.2	S	30.1	06/16	1016.6
45003	45.3N	082.7W	0714	1.8	1.8	0.6	3.0	12/12	11.1	NW	30.9	12/08	1016.3
45004	47.5N	086.5W	0538	1.3	1.5	0.8	5.0	12/08	11.9	SE	31.1	12/07	1017.2
45006	47.3N	089.9W	0413	1.8	1.4	0.9	4.3	21/09	8.5	NE	27.1	21/09	1015.9
45007	42.8N	087.1W	0719	3.4	3.2	0.7	2.7	01/09	11.0	N	24.3	01/06	1016.1
45008	44.3N	082.4W	0719	1.9	1.8	0.7	2.9	12/14	9.1	NW	22.2	12/13	1017.0
46001	56.3N	148.3W	0719	4.0	4.7	2.2	7.0	25/14	13.2	N	35.8	19/08	1007.7
46002	42.5N	130.3W	0718	11.6	12.3	2.6	5.4	17/14	13.5	S	27.4	11/12	1014.9
46003	51.9N	155.9W	0716	3.2	3.7	2.3	5.5	25/20	13.9	NW	26.4	19/16	1011.4
46005	46.1N	131.0W	0719	9.6	10.5	2.7	5.6	17/21	14.1	SW	31.3	24/09	1013.4
46011	34.9N	120.9W	0719	14.0	14.0	2.0	4.2	05/02	13.5	NW	27.2	05/03	1015.7
46012	37.4N	122.7W	0719	13.6	14.1	2.0	4.0	21/11	11.9	NW	30.3	05/01	1017.6
46022	40.8N	124.5W	0717	12.6	13.2	2.1	4.4	18/12	12.0	S	26.2	12/07	1017.7
46023	34.3N	120.7W	0719	14.3	14.3	2.1	4.5	05/05	16.2	NW	29.3	18/12	1015.2
46025	33.8N	119.1W	0719	16.9	17.7	1.1	2.4	18/15	5.8	W	20.4	22/06	1014.3
46026	37.8N	122.7W	0718	13.1	13.4	1.6	3.1	21/08	12.2	NW	33.0	22/02	1017.2
46027	41.8N	124.4W	0609	12.2	12.6	2.0	3.9	18/13					1017.5
46029	46.2N	124.2W	0720	11.3	11.0	2.1	4.3	17/07	11.0	S	26.8	17/04	1016.6
46035	57.0N	177.7W	0720	0.5	2.4	2.0	5.5	11/20	15.0	SE	32.8	11/20	1020.1
46040	44.8N	124.3W	0720	11.5		2.2	4.4	17/10	10.2	S	26.6	17/03	1016.3
46041	47.4N	124.5W	0715	10.4	11.5	2.0	4.3	17/00	10.7	SE	26.6	16/11	1015.4
46042	36.8N	122.4W	0718	13.7		2.0	4.3	21/15	13.2	NW	27.4	22/05	1017.4
46048	32.9N	117.9W	0719	17.4	19.0	1.0	1.9	19/05	6.6	W	19.6	14/09	1014.1
46050	44.6N	124.5W	0716	11.5	11.9	2.3	4.4	17/06	11.5	S	29.9	29/18	1017.2
46051	34.5N	120.7W	0719	13.9	13.9	2.0	4.1	05/08	14.3	NW	24.9	18/13	1015.8
51001	23.4N	162.3W	0720	22.2	23.4	2.0	3.5	02/07	9.5	NE	21.6	01/21	1016.5
51002	17.2N	157.8W	0715	24.0		2.0	3.2	29/17	11.3	NE	21.3	03/06	1014.7
51003	19.3N	160.8W	0654	24.1	25.2	1.8	3.0	29/23	9.0	NE	16.8	29/21	1014.4
51004	17.4N	152.5W	0718	23.4	24.1	2.0	3.2	03/10	11.2	E	23.2	28/19	1014.1
52009	13.7N	144.7E	0699	26.4	26.3	1.4	2.2	01/22	10.8	NE	18.8	20/21	1012.2
91222	18.1N	145.8E	0685	26.4					5.6	E	16.6	10/04	
91251	11.4N	162.4E	0706	26.3					15.1	E	24.7	18/20	1011.9
91328	8.4N	149.4E	0709	27.3					10.0	NE	16.2	03/03	1010.3
91343	7.6N	155.2E	0680	27.4					12.4	NE	22.6	25/23	1010.6
91355	5.4N	163.0E	0711	27.5					9.3	NE	19.1	16/05	1009.3
91377	6.1N	172.1E	0715	27.6					8.1	NE	27.0	13/00	1009.2
ALSN6	40.5N	073.8W	0718	7.3	6.8	0.8	1.9	11/15	13.5	SW	31.2	01/19	1017.0
BURL1	28.9N	089.4W	0379	17.6					9.5	NE	27.8	06/07	1019.5
BUZM3	41.4N	071.0W	0718	5.4		1.0	1.6	03/23	13.1	S	29.9	11/12	1015.9
CARO3	43.3N	124.4W	0718	11.9					10.5	S	30.7	17/01	1016.5
CHLV2	36.9N	075.7W	0718	11.3	10.2	1.0	2.9	13/16	16.1	S	35.4	22/10	1017.0
CLKN7	34.6N	076.5W	0719	15.6					11.1	SW	38.5	13/13	1017.5
CSBF1	29.7N	085.4W	0720	18.8					6.8	E	19.5	26/23	1017.2
DBLN6	42.5N	079.4W	0667	5.0					9.8	SW	25.5	03/00	1016.0
DESW1	47.7N	124.5W	0693	10.2					14.3	SE	38.5	16/12	1015.3
DISW3	47.1N	090.7W	0192	2.2					11.0	SW	26.5	01/03	1015.1

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
DPIA1	30.3N	088.1W	0718	19.0	20.7				11.5	SE	29.0	19/09	1016.4
DSLN7	35.2N	075.3W	0719	15.5	18.3	1.5	5.2	29/15	16.1	N	39.9	29/04	1017.1
FBIS1	32.7N	079.9W	0717	16.8					8.4	SW	28.7	13/11	1017.1
FFIA2	57.3N	133.6W	0717	5.8					10.7	N	30.4	26/00	1012.2
FPSN7	33.5N	077.6W	0717	17.5	18.3				14.4	S	44.1	13/14	1017.1
FWYF1	25.6N	080.1W	0669	22.7	24.3				15.4	E	28.8	14/19	1016.0
GBCL1	27.8N	093.1W	0720	20.6	22.4				12.2	SE	31.2	06/00	1015.9
GDIL1	29.3N	090.0W	0718	19.9	21.8				10.1	SE	27.4	06/13	1016.4
GLLN6	43.9N	076.5W	0667	3.6					10.6	W	31.4	13/00	1016.0
IOSN3	43.0N	070.6W	0720	4.9					14.2	S	32.4	03/13	1015.7
LNEL1	28.2N	089.1W	0147	22.1		1.2	2.8	07/02	14.8	SE	33.1	06/13	1018.3
MDRM1	44.0N	068.1W	0718	2.7					14.6	SW	34.0	13/11	1015.9
MISM1	43.8N	068.9W	0719	2.9					14.6	S	38.9	13/07	1015.4
MLRF1	25.0N	080.4W	0672	22.9	24.8				14.1	E	27.8	20/01	1015.4
MPCL1	29.4N	088.6W	0694	19.6	21.0				11.7	E	33.5	20/17	1017.0
NWPO3	44.6N	124.1W	0719	11.5					9.8	SW	32.3	16/11	1017.0
PILM4	48.2N	088.4W	0662	0.4					11.1	N	39.2	12/01	1016.8
PTAC1	39.0N	123.7W	0719	12.4					10.5	N	26.2	21/02	1018.0
PTAT2	27.8N	097.1W	0718	20.8	22.0				11.4	E	30.8	29/07	1014.3
PTGC1	34.6N	120.7W	0719	13.9					17.1	N	34.0	18/16	1015.8
ROAM4	47.9N	089.3W	0658	0.8	1.1				12.9	NE	35.6	21/21	1017.6
SANF1	24.5N	081.9W	0672	23.3	24.8				13.1	E	24.0	17/02	1015.4
SAUF1	29.9N	081.3W	0673	18.2	19.8				9.5	N	31.1	14/00	1017.0
SBIO1	41.6N	082.8W	0667	6.3					10.7	NE	27.6	16/21	1016.4
SGNW3	43.8N	087.7W	0665	3.7					10.9	N	29.2	01/03	1016.4
SISW1	48.3N	122.9W	0540	10.5					10.3	W	35.9	30/10	1014.7
SMKF1	24.6N	081.1W	0719	23.4	24.9				14.9	E	29.1	14/23	1015.6
SPGF1	26.7N	079.0W	0672	22.3	24.8								1015.8
SRST2	29.7N	094.1W	0719	19.5					10.5	SE	26.4	05/23	1015.2
STDM4	47.2N	087.2W	0702	1.3					14.7	N	41.0	12/05	1017.6
SVLS1	32.0N	080.7W	0719	18.3		0.8	2.5	13/19	12.3	S	33.2	13/15	1017.1
TPLM2	38.9N	076.4W	0673	10.5	10.3				10.5	S	29.1	13/10	1016.4
TTIW1	48.4N	124.7W	0719	9.7					13.1	NE	40.2	24/11	1015.7
VENF1	27.1N	082.5W	0720	20.4	22.3				9.5	NW	28.7	19/18	1016.3
WPOW1	47.7N	122.4W	0719	10.7					7.8	S	28.7	16/20	1015.3
MAY 1992													
32302	18.0S	085.1W	0737	20.8	22.1	1.9	3.9	29/17	11.5	SE	24.3	29/14	1015.5
41001	34.9N	073.0W	0741	20.3	21.6	1.7	3.6	20/23	10.6	NE	22.5	21/01	1016.3
41002	32.3N	075.2W	0740	21.6	22.3	1.7	3.5	22/02	11.5	NE	22.9	08/06	1016.2
41006	29.3N	077.4W	0742	23.0	24.0	1.5	3.3	22/16	10.5	SW	22.2	07/18	1016.4
41009	28.5N	080.2W	1486	23.3	24.3	1.1	2.6	23/01	9.5	E	19.6	07/21	1016.6
41010	28.9N	078.5W	1483	23.5	24.7	1.3	3.2	01/04	10.6	NE	22.5	14/14	1016.6
41016	24.6N	076.5W	0668	24.6	25.8				10.4	E	21.3	18/00	1014.8
42002	25.9N	093.6W	0742	24.2	24.6	0.9	1.9	07/08	10.1	SE	20.8	07/04	1015.9
42003	25.9N	085.9W	0743	24.5	26.4	0.6	2.2	07/10					1016.6
42019	27.9N	095.0W	0740	23.7	24.4	0.9	2.2	11/02					1015.4
42020	27.0N	096.5W	0742	24.3	25.0	1.0	2.2	10/17	11.8	SE	25.3	27/22	1014.7
42025	24.9N	080.4W	0708		25.9	0.4	1.3	19/11					
44004	38.5N	070.7W	0743	15.5	16.6	1.8	4.1	12/01	12.5	NE	29.0	11/21	1017.5
44005	42.6N	068.6W	0726	7.2	6.4	1.3	2.7	01/13	9.9	NE	22.9	24/21	1019.4
44007	43.5N	070.1W	0742	8.7	7.3	0.9	2.0	01/19	8.3	S	23.9	24/16	1019.5
44008	40.5N	069.4W	0741	8.3	6.8	1.5	3.0	05/21	12.2	NE	27.8	11/15	1018.3
44009	38.5N	074.7W	0738	11.8	10.7	1.3	3.6	08/00	12.2	NE	32.1	07/20	1018.4
44011	41.1N	066.6W	0744	6.1	4.1	1.6	3.3	01/07	9.6	NE	23.5	05/21	1019.4
44012	38.8N	074.6W	0741	11.5	10.4	1.2	3.1	08/04	11.7	NE	28.4	07/15	1018.3
44013	42.4N	070.8W	0744	10.5	8.8	0.7	2.1	25/18	10.8	NE	27.0	03/01	1019.7
44014	36.6N	074.8W	0742	11.6	9.7	1.6	4.5	07/16	9.1	N	24.1	07/06	1016.9
44025	40.3N	073.2W	0708	10.6	9.0	1.2	2.6	07/21	9.8	NE	24.7	24/21	1019.2
45001	48.1N	087.8W	0739	4.3	2.2	0.6	2.8	01/14	10.0	S	26.0	07/11	1017.7
45002	45.3N	086.4W	0740	5.5	3.3	0.6	2.3	01/20	8.7	S	20.6	01/15	1019.3
45003	45.3N	082.7W	0742	4.7	2.5	0.5	1.9	23/16	9.3	S	26.0	23/15	1019.1
45004	47.5N	086.5W	0742	4.3	2.4	0.7	2.4	23/07	10.4	S	25.5	01/11	1017.9
45005	41.7N	082.4W	0621	11.9	11.5	0.5	1.6	24/13	8.0	NE	22.2	24/00	1020.1
45006	47.3N	089.9W	0736	5.2	2.2	0.6	2.2	01/01	7.2	SW	20.1	01/00	1017.6
45007	42.8N	087.1W	0741	6.8	4.4	0.6	3.2	23/18	8.7	N	28.0	23/16	1019.2
45008	44.3N	082.4W	0741	5.5	3.0	0.6	2.2	24/10	8.2	N	21.2	01/20	1020.0
46001	56.3N	148.3W	0741	5.6	6.1	1.9	5.6	07/01	13.0	W	30.7	06/20	1014.9
46002	42.5N	130.3W	0738	12.8	13.8	1.8	3.3	07/04	10.2	N	21.8	06/18	1020.8
46003	51.9N	155.9W	0733	5.4	5.5	1.6	4.9	22/13	10.2	W	30.7	07/00	1017.5
46005	46.1N	131.0W	0741	10.8	11.6	2.0	3.9	02/04	13.1	N	21.4	06/14	1020.7
46011	34.9N	120.9W	0741	14.6	15.0	1.6	3.6	21/10	9.3	NW	28.0	21/00	1014.1
46012	37.4N	122.7W	0743	13.5	13.7	1.7	4.3	01/05	8.7	NE	25.6	09/23	1014.8
46022	40.8N	124.5W	0741	12.4	12.8	1.9	5.0	09/08	10.5	N	27.8	09/09	1016.4
46023	34.3N	120.7W	0742	14.6	14.7	1.7	4.0	01/11	11.4	NW	26.0	01/08	1013.9
46025	33.8N	119.1W	0741	16.7	18.2	0.9	2.0	21/07	5.4	W	18.1	20/03	1013.4
46026	37.8N	122.7W	0710	12.9	13.4	1.3	2.8	09/09	10.4	W	28.2	21/02	1014.3
46027	41.8N	124.4W	0639	11.6	11.0	1.7	3.6	27/01					1015.9
46029	46.2N	124.2W	0741	12.7	13.3	1.6	2.8	05/01	9.9	NW	24.1	05/23	1019.2
46035	57.0N	177.7W	0744	1.7	3.9	1.5	7.6	11/10	12.6	NE	33.8	10/22	1020.2
46040	44.8N	124.3W	0723	12.5		1.7	3.0	03/01					1018.3
46041	47.4N	124.5W	0743	11.6	12.1	1.5	2.8	20/10	9.0	NW	26.0	06/00	1018.6
46042	36.8N	122.4W	0743	13.6		1.9	4.2	09/11	9.9	NW	25.6	09/20	1014.9
46048	32.9N	117.9W	0743	17.2	19.5	0.9	1.8	07/21	7.6	W	21.4	20/02	1013.3
46050	44.6N	124.5W	0741	12.8	12.9	1.7	3.1	03/00	11.9	N	23.7	06/01	1019.1
46051	34.5N	120.7W	0740	14.3	14.2	1.6	3.4	01/11	10.1	NW	23.9	01/09	1014.3
51001	23.4N	162.3W	0743	23.1	24.6	1.8	3.6	07/11	10.5	NE	25.3	06/14	1015.0
51002	17.2N	157.8W	0740	25.3		1.8	3.7	07/00	10.0	E	21.7	06/19	1014.1
51003	19.3N	160.8W	0743	24.9	26.0	1.7	3.9	07/12	9.3	NE	21.8	06/22	1013.6
51004	17.4N	152.5W	0743	24.7	25.6	1.8	3.8	08/14	10.3	E	20.8	06/04	1013.5
52009	13.7N	144.7E	0568	27.0	26.9	1.1	2.2	12/02	10.0	E	20.0	02/22	1011.0
91222	18.1N	145.8E	0450	27.7					6.2	E	16.4	03/01	1010.2
91251	11.4N	162.4E	0733	28.7					14.4	E	22.2	30/13	1011.2

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
91328	8.4N	149.4E	0737	27.8					7.9	NE	18.3	10/00	1009.4
91343	7.6N	155.2E	0738	27.9					10.2	NE	18.0	04/04	1009.8
91355	5.4N	163.0E	0732	27.3					7.7	NE	21.3	02/20	1008.7
91377	6.1N	172.1E	0739	27.4					10.0	NE	24.8	03/20	1008.9
ALSN6	40.5N	073.8W	0742	12.7	11.4	1.1	2.6	07/22	13.2	E	32.3	31/12	1019.6
BURL1	28.9N	089.4W	0741	23.0					10.4	E	27.0	07/03	1017.1
BUSL1	27.9N	090.9W	0742	24.4	24.4				9.3	E	24.1	07/04	1017.7
BUZM3	41.4N	071.0W	0624	10.1					14.5	NE	34.6	24/19	1019.0
CARO3	43.3N	124.4W	0742	12.4					9.2	N	24.0	12/04	1017.6
CHLV2	36.9N	075.7W	0742	13.7	12.8	1.2	4.1	07/22	14.6	NE	38.8	07/20	1018.2
CLKN7	34.6N	076.5W	0741	18.8					12.0	NE	30.0	07/14	1017.4
CSBF1	29.7N	085.4W	0741	21.9					7.4	W	18.0	29/13	1016.8
DBLN6	42.5N	079.4W	0701	12.2					8.8	SW	31.6	02/06	1018.4
DESW1	47.7N	124.5W	0742	11.6					10.0	NW	34.7	05/23	1018.7
DISW3	47.1N	090.7W	0439	10.3					8.2	NE	24.1	15/03	1019.3
DPIA1	30.3N	088.1W	0740	22.3	24.3				9.4	SW	31.5	06/12	1016.7
DSLN7	35.2N	075.3W	0741	17.6	18.4	1.6	4.2	07/14	14.7	N	38.8	08/09	1017.2
FBIS1	32.7N	079.9W	0743	20.5					9.8	SW	26.9	07/05	1016.4
FFIA2	57.3N	133.6W	0735	8.2					10.5	SE	33.9	04/06	1017.0
FPSN7	33.5N	077.6W	0741	20.5	21.5				15.0	NE	41.7	07/20	1016.5
FWYF1	25.6N	080.1W	0707	24.5	25.5				11.5	E	23.8	19/09	1015.8
GBCL1	27.8N	093.1W	0739	23.0	24.5				11.1	SE	26.1	07/05	1016.5
GDIL1	29.3N	090.0W	0742	23.3	25.4				9.0	SE	24.4	06/13	1016.7
GLLN6	43.9N	076.5W	0701	10.4					9.3	SE	28.3	03/06	1018.7
IOSN3	43.0N	070.6W	0741	10.1					10.8	NE	25.9	24/18	1019.8
LNEL1	28.2N	089.1W	0430	24.2		0.8	1.7	22/03	9.2	W	9.8	13/13	
MDRM1	44.0N	068.1W	0735	6.3					10.3	SW	27.0	05/11	1020.5
MISM1	43.8N	068.9W	0741	6.8					10.4	NE	24.0	05/13	1019.9
MLRF1	25.0N	080.4W	0705	24.6	25.8				10.2	E	22.9	08/02	1015.2
MPCL1	29.4N	088.6W	0730	22.8	24.4	0.7	2.1	21/21	10.1	E	27.9	07/08	1017.2
NWPO3	44.6N	124.1W	0740	11.8					9.0	NW	24.8	06/01	1018.5
PILM4	48.2N	088.4W	0702	5.5					11.1	SW	28.8	01/12	1017.3
PTAC1	39.0N	123.7W	0742	12.1					10.2	N	27.2	09/01	1015.1
PTAT2	27.8N	097.1W	0741	23.4	24.9				12.4	SE	28.2	11/11	1014.6
PTGC1	34.6N	120.7W	0741	14.1					12.6	N	28.9	09/03	1014.3
ROAM4	47.9N	089.3W	0689	7.6	2.4				12.9	SW	34.3	11/05	1018.3
SANF1	24.5N	081.9W	0708	24.5	25.6				9.5	E	22.7	19/23	1015.4
SAUF1	29.9N	081.3W	0698	21.2	22.5				9.0	SW	26.2	07/01	1016.1
SBIO1	41.6N	082.8W	0682	13.5					8.7	NE	32.0	17/19	1018.0
SGNW3	43.8N	087.7W	0702	10.8					10.5	S	29.1	24/08	1019.0
SISW1	48.3N	122.9W	0740	11.7					9.7	W	31.9	10/19	1018.1
SMKF1	24.6N	081.1W	0740	24.8	25.8				10.5	E	23.8	19/23	1015.6
SPGF1	26.7N	079.0W	0707	24.1	26.4				8.1	E	21.9	18/00	1016.2
SRST2	29.7N	094.1W	0742	22.7					10.5	SE	23.3	06/15	1015.9
STDM4	47.2N	087.2W	0738	6.5					16.6	S	36.4	10/21	1017.6
SVLS1	32.0N	080.7W	0728	20.0		0.8	2.0	07/00	12.8	NE	32.1	06/23	1016.3
TPLM2	38.9N	076.4W	0705	15.5	15.7				10.1	NE	27.3	08/03	1018.5
TTIW1	48.4N	124.7W	0741	11.2					10.7	S	28.9	03/17	1019.0
VENF1	27.1N	082.5W	0741	22.3	23.9				8.4	NW	32.7	07/22	1016.0
WPOW1	47.7N	122.4W	0742	13.0					5.6	NE	26.3	09/21	1017.3
JUNE 1992													
32302	18.0S	085.1W	0712	19.5	20.7	2.3	4.2	18/06	13.0	SE	22.9	08/08	1016.7
41001	34.9N	073.0W	0719	22.6	23.3	1.3	2.6	27/21	10.3	SW	30.3	10/05	1013.9
41002	32.3N	075.2W	0719	24.7	25.1	1.4	3.1	27/15	11.3	S	28.2	13/01	1013.5
41004	32.5N	079.1W	0342	25.5	26.2	1.1	2.6	26/20	10.1	SW	24.1	26/16	1013.0
41006	29.3N	077.4W	0719	25.9	26.2	1.2	3.3	27/00	10.6	S	25.3	24/10	1014.2
41009	28.5N	080.2W	1436	25.9	26.3	0.7	2.1	25/21	9.7	SW	24.9	29/19	1014.0
41010	28.9N	078.5W	1425	26.4	26.6	1.1	3.8	26/21	10.6	SW	29.1	26/12	1014.2
41016	24.6N	076.5W	0720	27.2	27.7				10.1	SE	22.2	24/10	1014.5
42001	25.9N	089.7W	0648	27.9	28.6	0.5	1.5	07/21	7.8	S	21.0	08/10	1013.0
42002	25.9N	093.6W	0718	27.7	28.1	0.7	1.6	07/21	7.9	SE	23.5	08/05	1012.0
42003	25.9N	085.9W	0712	27.5	28.5	1.1	1.9	27/21	13.1	SW	23.5	28/06	1013.5
42007	30.1N	088.8W	0657	26.8	27.9				9.5	SW	23.5	08/21	1011.7
42019	27.9N	095.0W	0712	27.5	28.0	0.7	1.9	30/23	8.4	S	23.5	06/22	1011.0
42020	27.0N	096.5W	0719	27.7	28.3	0.8	2.1	15/08	10.9	SE	23.1	29/17	1010.5
42025	24.9N	080.4W	0720		28.2	0.4	1.3	24/03					
44004	38.5N	070.7W	0719	20.1	20.8	1.2	4.9	06/06	9.5	S	36.3	06/01	1014.4
44005	42.6N	068.6W	0701	13.1	11.6	1.1	3.3	06/21	10.7	SW	24.1	06/02	1012.3
44007	43.5N	070.1W	0719	14.3	12.0	0.7	2.7	07/05	10.0	S	21.8	06/17	1011.5
44008	40.5N	069.4W	0719	13.6	10.4	1.0	3.5	06/13	10.4	SW	25.5	02/07	1013.3
44009	38.5N	074.7W	0716	18.2	17.8	0.8	2.2	06/12	9.4	S	23.5	22/02	1013.9
44011	41.1N	066.6W	0711	12.3	9.8	1.2	3.6	06/23	7.7	SW	19.8	22/23	1014.6
44012	38.8N	074.6W	0718	17.6	16.7	0.8	2.4	06/10	9.6	S	27.8	09/08	1013.6
44013	42.4N	070.8W	0720	16.6	13.3	0.5	2.3	06/09	11.0	SW	28.0	01/15	1012.4
44014	36.6N	074.8W	0715	17.9	12.9	1.0	2.2	05/16	6.0	NE	19.2	22/06	1013.5
44025	40.3N	073.2W	0707	17.2	15.7	0.9	3.1	06/15	9.3	S	23.5	22/20	1013.4
45001	48.1N	087.8W	0720	5.3	3.2	0.5	2.1	17/12	7.9	SW	25.6	17/11	1013.7
45002	45.3N	086.4W	0718	11.1	9.6	0.5	2.3	17/22	7.7	S	25.1	17/21	1014.0
45003	45.3N	082.7W	0720	7.0	3.9	0.4	2.0	18/06	7.9	W	23.1	18/06	1013.6
45004	47.5N	086.5W	0715	5.3	3.3	0.5	2.0	18/23	8.2	E	23.5	17/14	1013.6
45005	41.7N	082.4W	0719	17.0	17.5	0.5	2.0	15/21	7.9	E	30.7	18/10	1013.5
45006	47.3N	089.9W	0719	6.1	3.2	0.5	1.5	17/10	6.7	NE	15.2	14/17	1013.7
45007	42.8N	087.1W	0699	12.7	11.7	0.7	2.8	19/10	8.1	N	27.0	17/21	1013.6
45008	44.3N	082.4W	0718	10.6	8.9	0.5	2.2	19/13	7.1	NW	23.2	18/04	1014.4
46001	56.3N	148.3W	0719	8.3	8.6	1.7	6.6	03/22	11.9	W	33.2	03/16	1014.8
46002	42.5N	130.3W	0718	14.2	15.0	1.8	4.0	09/22	13.0	N	22.3	09/12	1018.0
46003	51.9N	155.9W	0716	8.0	7.6	1.9	4.1	04/15	13.0	S	25.6	03/05	1012.3
46005	46.1N	131.0W	0719	12.6	13.6	1.5	2.9	09/18	10.7	N	19.6	16/15	1017.8
46006	40.9N	137.5W	0334	15.6	16.2	1.7	3.6	29/18	10.3	SW	24.3	29/09	1017.5
46011	34.9N	120.9W	0716	14.8	15.2	1.6	3.5	14/07	9.5	NW	29.0	14/04	1013.4
46012	37.4N	122.7W	0717	13.7	13.7	1.5	2.8	02/15	8.5	NW	24.5	14/07	1013.8

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
46013	38.2N	123.3W	0189	14.0	13.4	1.1	2.4	30/17	4.8	W	17.3	29/20	1012.3
46014	39.2N	124.0W	0175	14.2	14.5	1.1	2.8	30/20	6.2	SE	25.8	29/20	1012.0
46022	40.8N	124.5W	0715	12.5	12.3	1.9	4.3	05/03	10.5	N	24.9	02/11	1014.3
46023	34.3N	120.7W	0716	14.9	15.2	1.7	3.6	14/08	12.6	NW	24.9	13/23	1013.0
46025	33.8N	119.1W	0717	16.1	17.2	0.9	2.4	16/05	6.7	W	20.0	13/00	1012.3
46026	37.8N	122.7W	0699	13.0	13.4	1.2	2.5	15/02	9.8	W	27.0	15/04	1013.3
46027	41.8N	124.4W	0643	11.7	10.8	1.8	4.2	05/22					1013.6
46028	35.8N	121.9W	0438	15.1	17.9	1.6	3.3	14/13	11.1	NW	26.0	13/02	1014.5
46029	46.2N	124.2W	0627	13.8	13.8	1.4	2.6	10/11	10.2	NW	20.3	29/18	1016.2
46035	57.0N	177.7W	0720	5.2	5.7	1.7	5.1	25/08	14.7	NE	31.3	25/09	1003.2
46040	44.8N	124.3W	0047	12.6		1.8	2.8	02/14					1019.5
46041	47.4N	124.5W	0715	12.8	12.8	1.3	2.7	02/03	8.9	NW	22.3	22/00	1015.3
46042	36.8N	122.4W	0718	14.1		1.8	3.3	02/18	9.8	NW	23.9	14/05	1014.0
46048	32.9N	117.9W	0719	17.2	19.4	1.0	2.1	14/07	8.8	W	23.3	13/03	1012.1
46050	44.6N	124.5W	0716	13.7	13.6	1.5	3.1	03/05	11.7	N	23.9	02/04	1016.2
46051	34.5N	120.7W	0718	14.0	13.6	1.6	3.7	14/08	10.4	NW	23.1	13/23	1013.5
51001	23.4N	162.3W	0717	25.1	25.8	1.7	2.8	14/18	12.6	SW	20.6	17/13	1017.5
51002	17.2N	157.8W	0719	25.7		2.1	3.4	14/15	15.7	E	23.7	13/21	1014.2
51003	19.3N	160.8W	0719	26.0	27.0	1.7	2.8	13/20	11.6	E	20.8	25/05	1014.3
51004	17.4N	152.5W	0720	25.3	26.3	2.1	3.5	15/15	14.8	E	22.1	12/17	1013.5
52009	13.7N	144.7E	0270	27.9	27.5	1.3	2.3	20/04	13.0	E	19.8	18/23	1010.4
91222	18.1N	145.8E	0669	28.0					8.0	E	16.8	28/23	1012.1
91251	11.4N	162.4E	0713	27.2					16.0	E	24.2	18/03	1010.6
91328	8.6N	149.7E	0717	27.9					7.8	NE	16.2	16/19	1008.6
91343	7.6N	155.2E	0717	27.8					11.7	NE	25.9	18/13	1009.1
91355	5.4N	163.0E	0711	27.7					6.6	E	18.6	17/23	1008.0
91377	6.1N	172.1E	0716	27.6					9.6	NW	24.4	12/20	1008.2
ALSN6	40.5N	073.8W	0717	17.4	15.5	0.8	2.5	06/14	13.8	SW	32.7	05/16	1013.8
BURL1	28.9N	089.4W	0720	27.1					9.3	SW	28.9	08/18	1012.0
BUSL1	27.9N	090.9W	0718	28.7	27.7				7.9	SE	27.1	30/12	1010.2
BUZM3	41.4N	071.0W	0446	15.7					13.6	SW	30.9	06/07	1013.1
CARO3	43.3N	124.4W	0718	12.6					8.9	N	26.9	02/10	1015.0
CHLV2	36.9N	075.7W	0717	20.1	19.5	0.8	1.6	06/15	10.8	S	25.1	22/05	1014.3
CLKN7	34.6N	076.5W	0718	23.3					10.0	SW	26.1	04/21	1014.3
CSBF1	29.7N	085.4W	0720	26.4					7.7	SW	23.6	13/21	1012.6
DBLN6	42.5N	079.4W	0718	16.2					8.3	SW	25.8	24/15	1013.2
DESW1	47.7N	124.5W	0717	12.7					10.7	NW	33.6	23/01	1015.5
DISW3	47.1N	090.7W	0707	12.3					9.0	NE	26.3	18/08	1013.3
DPIA1	30.3N	088.1W	0719	26.4	28.1				8.1	SW	26.1	15/11	1012.4
DSLN7	35.2N	075.3W	0719	22.8	23.9	1.1	2.3	05/03	12.3	SW	29.5	26/20	1014.3
FBIS1	32.7N	079.9W	0651	24.7					10.2	SW	24.5	12/21	1013.0
FFIA2	57.3N	133.6W	0718	11.5					7.3	N	42.1	21/05	1015.8
FPSN7	33.5N	077.6W	0714	24.2	24.8				12.1	NE	30.7	04/18	
FWYF1	25.6N	080.1W	0720	27.1	27.7				11.3	S	31.5	05/07	1014.2
GBCL1	27.8N	093.1W	0719	26.8	28.0				9.2	S	30.3	07/00	1012.1
GDIL1	29.3N	090.0W	0716	27.3	29.4				7.8	SW	26.9	30/11	1011.9
GLLN6	43.9N	076.5W	0247	15.1					8.1	S	16.7	27/21	1011.5
IOSN3	43.0N	070.6W	0719	16.1					13.0	S	28.4	06/11	1012.0
LNEL1	28.2N	089.1W	0395	26.4		0.6	1.9	18/01					1015.8
MDRM1	44.0N	068.1W	0720	10.6					11.3	SW	28.0	06/03	1012.9
MISM1	43.8N	068.9W	0720	11.9					13.2	SW	31.1	06/03	1012.1
MLRF1	25.0N	080.4W	0701	27.3	28.1				9.2	S	24.7	29/00	1013.6
MPCL1	29.4N	088.6W	0695	26.7	28.2				9.5	SW	38.4	30/14	1012.5
NWPO3	44.6N	124.1W	0716	12.7					9.5	N	28.5	02/23	1015.8
PILM4	48.2N	088.4W	0718	7.2					10.4	W	30.1	18/00	1013.4
PTAC1	39.0N	123.7W	0715	12.5					9.6	N	30.6	21/22	1013.6
PTAT2	27.8N	097.1W	0717	26.8	27.9				10.6	SE	24.2	10/01	1010.3
PTGC1	34.6N	120.7W	0715	14.3					13.5	N	30.1	14/09	1013.4
ROAM4	47.9N	089.3W	0711	9.6	4.1				11.4	NE	34.3	28/12	1014.3
SANF1	24.5N	081.9W	0720	27.4	28.6				8.6	S	37.8	24/16	1013.5
SAUF1	29.9N	081.3W	0678	25.2	25.6				7.7	SW	29.4	25/20	1012.9
SBIO1	41.6N	082.8W	0718	18.1					7.7	NE	34.5	18/04	1012.9
SGNW3	43.8N	087.7W	0718	14.5					8.7	S	23.6	17/07	1013.7
SISW1	48.3N	122.9W	0717	13.1					10.1	SW	32.6	02/02	1014.7
SMKF1	24.6N	081.1W	0719	27.6	28.7				9.8	S	32.6	25/17	1013.9
SPGF1	26.7N	079.0W	0720	26.8	28.4				5.3	SW	23.4	13/03	1014.6
SRST2	29.7N	094.1W	0719	26.5					9.4	S	21.2	30/10	1010.8
STDM4	47.2N	087.2W	0717	10.3					14.6	SE	35.7	18/01	1013.2
SVLS1	32.0N	080.7W	0720	24.2		0.8	1.9	18/03	11.9	S	26.5	17/21	1012.9
TPLM2	38.9N	076.4W	0719	20.6	20.9				10.5	S	29.8	24/01	1013.6
TTIW1	48.4N	124.7W	0719	12.5					8.6	S	27.8	01/23	1015.8
VENF1	27.1N	082.5W	0701	26.3	28.9				9.2	SW	32.0	25/22	1013.1
WPOW1	47.7N	122.4W	0718	15.4					5.2	NE	19.8	29/14	1014.0

This discarded line is done fishing. But it's not done killing.

Carelessly discarded plastic fishing line can keep working long after you're done with it – entangling birds, seals, sea turtles, and other animals.

And because plastic line is strong and durable, it's nearly impossible for these animals to break free. They strangle, drown, or starve. That's not sporting.

Some birds even use old fishing line in their nests, creating death traps for their young.

Other plastic debris can be dangerous, too. Fish, birds, and seals become entangled in six-pack rings. Sea turtles eat plastic bags – which they mistake for jellyfish – and suffer internal injury, intestinal blockage, or death by starvation. Birds are known to ingest everything from small plastic pieces to plastic cigarette lighters and bottle caps.

Plastic debris also can foul boat propellers and block cooling intakes, causing annoying – sometimes dangerous – delays and causing costly repairs.

So please, save your old fishing line and other plastic trash for proper disposal.

That's not all you'll be saving.

To learn more about how you can help, write: Center for Marine Conservation, 1725 DeSales Street, N.W., Suite 500, Washington, D.C. 20036.

A public service message from:
The Center for Marine Conservation
The National Oceanic and Atmospheric Administration
The Society of the Plastics Industry

Northwest England
Captain Albert Britain, PMO
Room 218,
Royal Liver Building
Liverpool L3 1HU
Tel: 051-236 6565 FAX: 051-227 4762

Scotland and Northern Ireland
Captain Stuart M. Norwell, PMO
Navy Buildings, Eldon St.
Greenock, Strathclyde
PA16 7SL
Tel: (0475) 24700 FAX: (0475) 892879

Bristol Channel
Captain Archie F. Ashton, PMO
Cardiff Weather Centre
Southgate House, Wood Street
Cardiff CF1 1EW
Tel: Cardiff(0222) 221423
FAX: (0222) 390435

Southwest England
Captain Douglas R. McWhan, PMO
8 Viceroy House
Mountbatten Business Centre
Millbrook Rd. East
Southampton SO1 OHY
Tel: Southampton (0703) 220632
FAX: (0703) 337341

Southeast England
Captain Clive R. Downes, PMO
Daneholes House, Hogg Lane
Grays, Essex
RM17 5QH
Tel: Grays Thurrock (0375) 378369
FAX: (0375) 379320

Northeast England
Captain Derek H. Rutherford, PMO
Room D418 Corporation House
73-75 Albert Road
Middlesbrough, Cleveland TS1 2RZ
Tel: Middlesbrough (0642) 231622
FAX: (0642) 242676

East England
Captain Edward J. O'Sullivan, PMO
C/O Department of Transport
Posterngate,Hull HU1 2JN
Tel: Hull (0482) 20158
FAX: (0482) 28957

Netherlands
Peter Schnitker, PMO
Aero. Met Division of KNMI
Rotterdam Airport
Tel: (010)- 437 0766

New Zealand
Ms. Julie Fletcher
Marine Meteorological Officer
New Zealand Met. Service
Tahi Rd., Box 1515
Paraparaumu Beach 6153
New Zealand Tel: (058) 73-237

Japan
Mr. I. Kawatsu, PMO
Yokohama Local Met. Observatory
Yamate-cho, Naka-ku
Yokohama, Japan
Tel: (045)-621-1991

Mr. M. Miyauchi
Japan Meteorological Agency
Otemachi, Chiyoda-ku
Tokyo, 100 Japan
Tel: (03)-212-8341

Hong Kong
Mr. Ip Sui Fui, PMO
134A Nathan Road
Kowloon, Hong Kong
Tel: 732-9263

Germany
Mr. Henning Hesse, PMO
Wetterwarte, An der neuen Schleuse
Bremerhaven Tel: (0471) 72220

Mr. Jurgen Guehne, PMO
Seewetteramt
Bernhard Nocht-Strasse 76
Hamburg Tel: (040) 3190 8826

Kenya
Mr. Ali J. Mafimbo, PMO
PO Box 98512
Mombassa
Tel: (11) 25685 or 433440

Saudi Arabia
Mr. M. Murwani, PMO
National Meteorological Environment Centre, Jeddah
Tel: (02) 683-4444 ext. 325

Singapore
Mr. Edmund Lee, PMO
Meteorological Service, PO Box 8
Singapore Changi Airport
Tel:5457198

France
Mr. Yann Prigent, PMO
Station Météorologique
Noveau Semaphore
Quai des Abeilles, Le Harve
Tel: 35.42.21.06

Mr. A. Rouzier
Station Météorologique
de Marseille-Port
12 rue Sainte Cassien
13002 Marseille
Tel: 91.91.46.51, poste 336

South Africa
Mr. C. Sydney Marais, PMO
Roggebaai, Capetown, 8012
Tel: (021) 217543

Mr. Peter Rae, PMO
Meteorological Office
Louis Botha Airport, Durban 4029

Australia
Captain Alan H. Pickles, PMO
Stirling Marine
17 Mews Road
Fremantle, WA 6160
Tel: (09) 335 8444 Fax: (09) 335 3286.
Telex: 92821

Mr. M. Hills, PMO
Pier 14, Victoria Dock
Melbourne, Vic. Tel: (03) 629 1810

Mr. E.E. Rowlands, PMO
NSW Regional Office
Bureau of Meteorology
P.O. Box A737
Sydney South, NSW 2000
Tel: (02) 269 8555

Greece
Mr. George E. Kassimidis, PMO
Port Office, Piraeus
Tel: (01) 89-32914

SEAS Field Representatives
Mr. Robert Decker
Seas Logistics/ PMC
7600 Sand Point Way N.E.
Seattle, WA 98102
206-526-4280
FAX: 206-526-6365
TELEX 7408535/BOBD

Mr. Steven Cook
SEAS Operations Manager
8604 La Jolla Shores Dr.
La Jolla, CA 92037
619-546-7103
FAX: 619-546-7003
TELEX 7408528/ COOK UC

Mr. Jim Farrington
SEAS Logistics/ A.M.C.
439 West York St.
Norfolk, VA 23510
804-441-3062
FAX: 804-441-6495
TELEX7408830/ MAPA UC

Mr. Robert Benway
National Marine Fisheries Service
28 Tazwell Dr.
Narragansett, RI 02882
401-782-6295

Mr. Warren Krug
Atlantic Oceanographic & Met. Lab.
4301 Rickenbacker Causeway
Miami, FL 33149
305-361-4433
FAX: 305-361-4582

Steve Ranne, Petty Officer USN
FLENUMOCEANCEN, Code 64
Monterey, CA 93943
408-647-4428
FAX: 408-647-4489

Atlantic Ports

PMO
National Weather Service, NOAA
1600 Port Boulevard
Miami, FL 33132
305-358-6027

Mr. Lawrence Cain, PMO
National Weather Service, NOAA
Jacksonville International Airport
Box 18367
Jacksonville, FL 32229
904-741-4370

Mr. Earle Ray Brown, Jr., PMO
National Weather Service, NOAA
Norfolk International Airport
Norfolk, VA 23518
804-441-6326

Mr. James Saunders, PMO
National Weather Service, NOAA
Weather Service Office
BWI Airport
Baltimore, MD 21240
410-850-0529

Mr. Martin Bonk, PMO
National Weather Service, NOAA
Building 51
Newark International Airport
Newark, NJ 07114
201-645-6188

PMO
National Weather Service, NOAA
30 Rockefeller Plaza
New York, NY 10112
212-399-5569

Mr. Randy Sheppard, PMO
Atmospheric Environment Service
1496 Bedford Highway
Bedford, (Halifax) Nova Scotia B4A
1ES 902-426-6703

Mr. Denis Blanchard
Atmospheric Environment Service
100 Alexis Nihon Blvd., 3rd Floor
Ville St. Laurent, (Montreal) Quebec
H4M 2N6
514-283-6325

Mr. D. Miller, PMO
Atmospheric Environment Service
Bldg. 303, Pleasantville
P.O. Box 9490, Postal Station "B"
St. John's, Newfoundland A1A 2Y4
709-772-4798

Gulf of Mexico Ports

Mr. John Warrelmann, PMO
National Weather Service, NOAA
Int'l Airport, Moisant Field, Box 20026
New Orleans, LA 70141
504-589-4839

Mr. James Nelson, PMO
National Weather Service, NOAA
Houston Area Weather Office
1620 Gill Road
Dickinson, TX 77539
713-534-2640

Pacific Ports

PMO, W/PRx2
Pacific Region, NWS, NOAA
Prince Kuhio Fed. Bldg., Rm 411
P.O. Box 50027
Honolulu, HI 96850
808-541-1670

Mr. Robert Webster, PMO
National Weather Service, NOAA
501 West Ocean Blvd.
Room 4480
Long Beach, CA 90802-4213
310-980-4090
TELEX: 7402731/BOBW UC

Mr. Robert Novak, PMO
National Weather Service, NOAA
Coast Guard Island P.O. Box 5027
Alameda, CA 94501
510-273-6257 (FTS 536-6257)
TELEX: 7402795/WPMO UC

Mr. David Bakeman, PMO
National Weather Service, NOAA
7600 Sand Point Way, N.E.
BIN C15700
Seattle, WA 98115
206-526-6100

Mr. Bob McArter, PMO
Atmospheric Environment Service
700-1200 W. 73rd Av.
Vancouver, British Columbia
V69 6H9
604-664-9136

Mr. Lee Kelley, MIC
National Weather Service, NOAA
Box 37, USCG Base
Kodiak, AK 99619
907-487-2102/4338

Mr. Lynn Chrystal, OIC
National Weather Service, NOAA
Box 427
Valdez, AK 99686
907-835-4505

Marine Program Mgr. W/AR121x3
Alaska Region
National Weather Service
222 West 7th Avenue #23
Anchorage, AK 99513-7575
907-271-5121

Great Lakes Ports

Mr. Bob Collins, PMO
National Weather Service, NOAA
333 West University Dr.
Romeoville, IL 60441
815-834-0600

Mr. George Smith, PMO
National Weather Service, NOAA
Hopkins International Airport
Federal Facilities Bldg.
Cleveland, OH 44135
216-265-2374

Port Meteorological Officer
Atmospheric Environment Service
25 St. Clair Av. East
Toronto, Ontario
M4T 1M2
416-973-5809

Mr. Ronald Fordyce
National Water Research Institute
Port Meteorological Office
P.O. Box 5050
867 Lakeshore Rd.
Burlington, Ontario
L7R 4R6
416-336-6420 (FAX 416-336-4797)

FTS Now uses commercial no.

U.S. Headquarters

Mr. Vincent Zegowitz
Marine Obs. Program Leader
National Weather Service, NOAA
1325 East West Highway
Silver Spring, MD 20910
301-713-1724

Mr. Martin Baron
VOS Program Manager
National Weather Service, NOAA
Room 17345
1325 East West Highway
Silver Spring, MD 20910
301-713-1724

Richard DeAngelis, Editor
Mariners Weather Log, NODC
1825 Connecticut Av., NW
Washington, DC 20235
202-606-4561
Fax: 202-606-4586

United Kingdom Headquarters

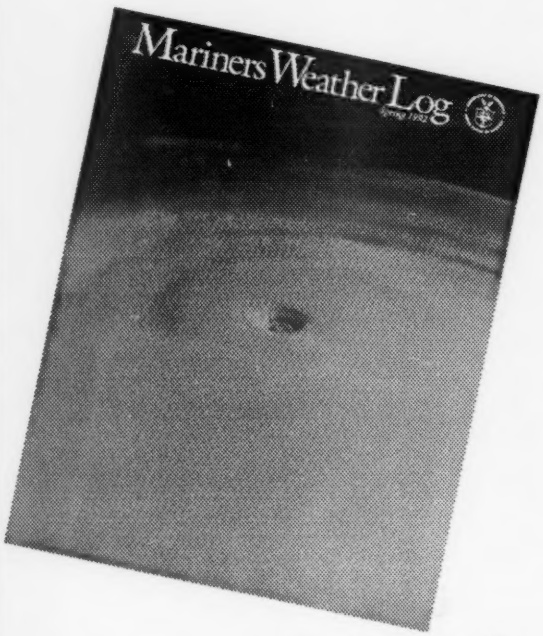
Captain Gordon V. Mackie,
Marine Superintendent, BD (OM)
Meteorological Office Met O (OM)
Scott Building, Eastern Road
Bracknell, Berks RG12 2PW
Tel:(0344) 855654 Fax: (0344)
855921
Telex: 849801 WEABKA G

Australia Headquarters

Mr. A.D. Baxter, Headquarters
Bureau of Meteorology
Regional Office for Victoria, 26 floor
150 Lonsdale Street
Melbourne, Vic 3001
Tel: (03) 669 4000

Mariners Weather Log

Serving the Maritime Community



Superintendent of Documents Subscriptions Order Form

Order Processing Code*
*** 5299**

☐ **YES, please enter my subscription(s) as follows.**

Charge your order.
It's Easy!

To fax your order (202) 512-2233

____subscriptions to ***Mariners Weather Log*** (MWL) for $12 per year ($15 foreign)

The total cost of my order is $____. Price includes regular domestic postage and handling and is subject to change.to change.

_____
(Company or Subscriber Name (Please type or print)

_____
(Additional address/attention line)

_____
(Street address)

_____
(City, State, Zip Code)

_____
(Daytime Telephone No. with area code)

_____
(Purchase Order Number)

For privacy protection,check the box below:

☐ Do not make my name available to other mailers.

Please choose method of payment:

☐ Check payable to the Superintendent of Documents

☐ GPO Deposit Account ☐☐☐☐☐☐☐—☐

☐ VISA or MasterCard Account

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

☐☐☐☐ (Credit card exp. date.

Thank you for your order!

_____
(Authorizing Signature)

Mail to: Superintendent of Documents
P.O. Box 37195
Pitttsburgh, PA 15250-7954

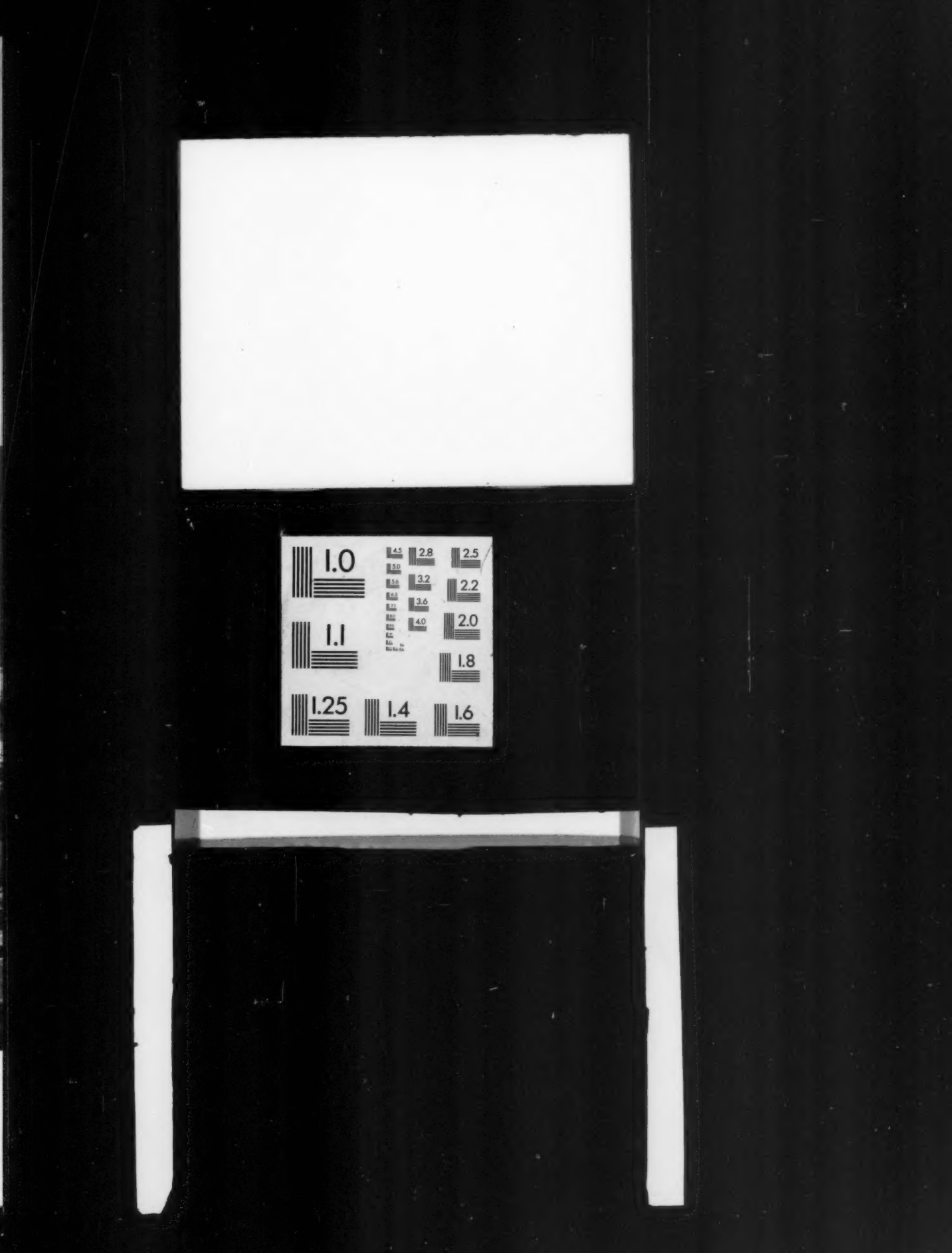
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
Publication distribution Facility
Rockville, MD 20852–3809
ATTN: Mariners Weather Log

40

Address Correction Requested
OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

Book Rate

For Sale by U.S. Government Printing Office
Superintendent of Documents,P. O. Box 37195, Pittsburgh, PA 15250–7954


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
7.1
8.0
9.0